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THE LIFE-HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—II.

PLATE I, FIGS. 1–24.

By HARRISON G. DYAR, A. M., Ph. D. and MISS EMILY L. MORTON.

Sibine stimulea *Clemens*.

1860.—*Empretia stimulea* CLEMENS, Proc. Acad. Nat. Sci. Phila. XII, 158.
1862.—*Empretia stimulea* MORRIS, Synop. Lep. 130.
1864.—*Empretia stimulea* PACKARD, Proc. Ent. Soc. Phila. III, 340.
1869.—*Limacodes ephippiatus* HARRIS, Corresp. p. 361, pl. 1, fig. 7.
1890.—*Empretia stimulea* PACKARD, 5th Rept. U. S. Ent. Com. 147.
1892.—*Empretia stimulea* KIRBY, Syn. Cat. Lep. Het. I, 539.
1892.—*Sibine ephippiatus* KIRBY, Syn. Cat. Lep. Het. I, 540.
1894.—*Sibine stimulea* NEUMOEGEN and DYAR, Journ. N. Y. Ent. Soc. II, 72.

LARVA.

1860.—Clemens, Proc. Acad. Nat. Sci. Phila. 159.
1869.—Harris, Corresp. p. 175, pl. 2, figs. 10, 11.
1869.—Packard, Guide Stud. Ins. 289.
1876.—Wetherby, Cincin. Journ. Sci. II, 369.
1877.—French, Trans. Dept. Agr. Ill. XV, 187.
1883.—Saunders, Ins. Inj. Fruits, 113.
1885.—Hubbard, Ins. Aff. Orange, 142.
1888.—Beutenmüller, Ent. Amer. IV, 75 (Food Plants).
1890.—Packard, 5th Rept. U. S. Ent. Comm. p. 146, fig. 50; p. 424 (Food Plants).
1893.—Packard, Proc. Am. Phil. Soc. XXXI, 85, pl. I, figs. 1–3 (egg larval stages).
1894.—Dyar, Ann. N. Y. Acad. Sci. VIII, 216.
1895.—Comstock, Manual Stud. Ins. 225, fig. 246.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal and lateral spaces broad, subventral space narrow, contracted. Ridges very slight, the subdorsal indicated only by the change in direction in the slope of the body, lateral and subventral ridges more distinct, approximate. The ancestral warts converted into fleshy horn-like processes, unequally elongated; in stage I bearing a few slender setæ (Plate I, fig. 1); after the first molt, the subdorsal and lateral rows covered with numerous urticating spines, the subventral row rudimentary, represented by two weak setæ. Of the subdorsal row, the "horns" on joints 3 to 5 and 11 to 13 are distinct, those on joints 6 to 10 rudimentary, but a seta is present even in the last stage. Of the lateral row, the one on joint 5 is absent.

Depressed areas very feebly developed, only their glandular centers distinguishable as slight pits, partially free from skin spines; the dorsal row (1) consequently paired, the addorsal row (2) still slighter, only distinguishable on certain segments or at favorable times, such as just before a molt. Of the lateral rows, the lateral (4) and lower intersegmental lateral (6) can be made out as slight pits. No others visible. In the contracted subventral space, the two large rows (7 and 8) appear as faint glandular dots, nearly in line. Skin at first smooth, in the later stages finely spinulose.

At the last molt, besides certain changes in color, the length of the "horns" is markedly reduced and their skin-spines shortened. Certain highly modified, easily detachable skin-spines appear, the shorter ones, designated "caltropes" by Dr. Packard, occur in patches at the ends of the horns of the lateral row on joints 6 to 11; the long ones arise from four circular areas of the skin at the posterior end of the body between the terminal horns, and correspond to the caltrope patches of the lateral horn of joint 12 and the subdorsal one of joint 13, which bear the true caltropes in the lower forms of our "larvæ of type 2."

The coloration is bright and conspicuous, being probably of a warning nature connected with the defensive armor. It is of a peculiar and striking pattern, which doubtless aids in the effect produced.

The larva is a generalized one in the slight degree of retraction of joint 2; the presence of many-spined warts; the slightly marked ridges and poorly developed skin structure. It is specialized in the unequal degree of prolongation of the warts on the several segments, the wart of the lateral row on joint 5 being entirely suppressed, while the spiracle on that segment is moved up out of line with the others; in the

conversion of the primitive setæ into urticating spines on the two upper rows of warts and in the development of certain detachable specialized skin spines in the last stage.*

AFFINITIES, HABITS, ETC.

The genus *Sibine* contains but one species in North America, north of Mexico, though represented by several in Central and South America, with most interesting larvae, to judge by Sepp's figures. Our larva is nearly allied to *Euclea*, *Adoneta* and *Parasa*, possessing in common with them most of the special structural characters described above. It is the most specialized larva of its group ("type 2"). This is one of our most common species of Eucleidæ, and has a wide range of food plants; basswood, cherry, chestnut, oak, corn leaves and *Canna indica* being a few among its many favorites. The young larvæ feed indifferently on the upper or underside of the leaf, consuming all but a thin skin, and unlike *y-inversa*, feeding around themselves, leaving irregular patches on the surface where they have fed (Plate I, fig. 21) until they reach the third stage, when the whole leaf is devoured in large holes, either on the edge or in the body of the leaf.

The species is single brooded, the moths (Plate I, fig. 15) appearing in July. The males fly, seeking their mates in the early twilight, and on favorable nights (warm and damp with a slight breeze) come in swarms to the cages, their wings fluttering and dancing rapidly over the surface of the gauze wire, where the females are confined, or darting in circles about the cages seeking an entrance. The couples remain paired usually until the same hour the next evening, though occasionally they separate earlier. The females lay their eggs during the night, in patches of from thirty to fifty, on the upper side of the leaf. The eggs hatch in ten days, but the larvæ develop slowly, maturing in September or even not until October. The larva of *stimulea* is well known for its stinging properties; the nettle-like spines being capable of inflict-

* We conceive the "caltropes" (Plate I, fig. 5) to be modified skin spines and the long spines (Plate I, fig. 7) to be modified "caltropes." We trace the following series. In *Euclea indetermina* there are no detachable spine patches, but only "caltropes." *E. pœnulata* (*elliotii*) has one pair of patches; *E. delphinii* two pairs, but smaller and less developed than in *Sibine*. The spines also are smaller and have a swollen base, looking like elongate "caltropes." We expect to figure them when we reach *Euclea*. The caltropes are about the same size in all (0.068 mm.), but the spines become larger as they are better developed. In *pœnulata* their length is 0.28 mm.; in *delphinii*, 0.56 mm. and in *stimulea* 0.89.

ing quite a severe pain and retaining this power even when spun into the cocoon.

CRITICISMS OF PREVIOUS DESCRIPTIONS.

We have given a list of eleven descriptions or figures of this larva. All but one of them treat of the general characters of the larva, principally the mature larva. Harris' figures are probably the best, though far from exact. Dr. A. S. Packard in 1893 gave the first account of the life history, though but partially, with figures of structural details. His figure of stage I is incorrect in two respects. He represents three rows of tubercles on joints 3 to 5, where there are but two, and shows the spiracle on joint 5 in line with the others with a tubercle above it, whereas there is really no tubercle there and the spiracle is not in line (compare our figure, Plate I, fig. 1). Dr. Packard has well figured the principal other structural elements except the long detachable spines (Plate I, fig. 7). These are one of the most noticeable elements; but we have seen no exact published account of them. Harris calls them "deep purplish red, velvet-like spots;" Packard mentions them as "a pair of rust brown flattened branches of singular spinules" and Dyar refers briefly to an "elevated brown structure like many spines close together" in his general description of the mature larva. The Rev. J. L. Zabriskie has exhibited preparations of these spines to the New York Entomological Society, but the minutes of the meeting have not been published.

Dr. Packard describes the several stages as if there were but five. He appears to have had stage I, stage IV toward the end of the stage, stage V (described twice) and stage VIII, the last; but he has numbered them consecutively.

Mr. Dyar, in his description of the mature larva, has referred, by error, the last two horns of the subdorsal row to the lateral row, which causes him to speak of "an extra pair at the anus" and to locate the spine patches wrongly.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—(Plate I, fig. 20). Elliptical, very flat, almost as thin as paper, thin shelled, laid in a mass of fifty or more, imbricate in alternating rows like shingles on a roof, neatly and regularly set. Transparent, yellowish, clear, the shell covered with neat irregularly hexagonal, pentagonal or even quadrangular reticulate opaque lines; rarely one of these cell areas is circular. The lines are narrow, not perceptibly

raised, but very distinct. Surface smooth and level, or a little grooved longitudinally from shrinking. Dimensions 1.8 x 1.2 x 0.1 mm.

The embryo lies curled on its side, the head and tail touching, greatly flattened laterally. Before hatching it shortens and thickens, the egg swells up so as to be much higher than before and the larva emerges through a small hole which it eats in the shell.

Stage I.—(Plate I, fig. 1). Shape essentially as in the mature larva. The horns only grow a little after hatching, being distinct before. Tubercles of the subdorsal row (tubercles i+ii), of lateral row (iii), each with three setæ, all raised on conical projections of the body (Plate I, fig. 3) forming horns; those on joints 3, 4, 5, 11 and 12 of the subdorsal row about twice as long as the others. Lateral row on joints 3, 4, 6, to 12, subequal. Subventral row represented by small setæ. Joint 2 not retracted below joint 3 even when walking, setiferous. Cuticle smooth, without spines. Color entirely light yellow, without marks, the horns a little whitish. Head concolorous with the body, clear yellow; ocelli brown; width .3 mm. (calculated .25 mm.). Length on hatching 1.3 mm.

The larvæ do not feed in this stage, but after hatching and eating a portion of the shell become quiescent and molt in two days.

Stage II.—Horns densely spined with many sharp stiff bristles, as in the mature larva (Plate I, fig. 4). The subdorsal on joints 3 to 5, 11 and 12 longer than the others, but rather shorter conic than before; joints 6 to 10 with only one or two short setæ, the tubercles rudimentary. Lateral row moderately developed on joints 3 and 4, smaller on joints 6 to 12, the spines less numerous than on the subdorsal horns, some of them hair-like. Spiracles moderately distinct, arranged as in the figure of stage I. Color whitish yellow without marks. Segments distinct, skin smooth, with just an indication of granulations. Magnified 350 diameters, this appears as an irregular puncturing or confused shagreen of the surface, but indistinct. Joint 2, as in the previous stage. Head pale yellow, ocelli black, mouth brown; width .4 mm. (calculated .35 mm.). Cervical shield is distinct, dark, bisected, level with the skin. Toward the end of the stage, a whitish line appears along the subdorsal ridge, defined by black dots inwardly and a black line outwardly on joints 6 to 10; the horns become shaded with blackish, and the space between them crossed by transverse lines. Length of the larva, 1.3 to 2 mm.

Stage III.—(Plate I, fig. 2, diagram of the markings). Elliptical, highest through joints 4 and 5, diminishing posteriorly; ridges not

sharp, all rounded; subdorsal processes fleshy, hornlike, those on joints 3, 4, 5, 11 and 12 long, densely spined, on joints 7, 8 and 9 very short, consisting of a wart with three or four spines, rudimentary on joints 6 and 10, short on joint 13. Lateral row on joints 3, 4, 6 to 12, moderate, spined, those on joints 3 and 4 slightly larger than the others; on joint 13 a few spines. Subventral edge scarcely ridged, setiferous. Skin closely covered with minute spinulose granules, close set, without tubercular bases, a little sunken in places corresponding to the usual depressed areas, especially in the dorsal intersegmental ones, but obscurely, and the areas are scarcely distinguishable. The color is subject to some variation in different examples. When well developed, the color is light green, the horns translucent whitish, except the subdorsal on joint 4 which has a faint vinous tinge, on joint 5 dark purplish vinous, and on joint 11 pale purple. A waved black subdorsal line, the pair connected by shaded streaks over the dorsum on joints 3, 4, 5 and 11, about two on each segment, leaving square or rounded patches of the ground color between the pairs of horns, that on joint 5 distinctly round. Subdorsal band broken on joints 6 to 10 (Plate I, fig. 2) and on joints 7 to 9 bordered above by a white band, the dorsal space here filled in with a blackish shade, which forms an elongated patch. Posterior end of the body and lateral region immaculate. Head green, shaded with brownish below, eyes black; width .5 mm. Length of the larva 2 to 3 mm.

Stage IV.—Essentially as before, the markings better defined. Dorsal intersegmental depressions small, paired, or single next to the large horns, at the base of which is indicated a paired addorsal segmental row. Horns of both rows on joints 3 and 4 pale flesh pink, the subdorsal on joints 5 and 11 purple, on joint 12 yellowish, the rest nearly colorless. Dorsal and lateral region of joints 3 to 5 and dorsal region of joint 11 purple, except the small paired greenish impressed spots and an unpaired median oval yellow one on joints 5 and 11. Dorsal patch on joints 7 to 9 blackish, bordered with white at the sides and below by a waved line. This white and black marking is repeated around the rudimental subdorsal tubercle on joints 6 and 10, closely approximated to the adjacent large horn. Ground color of the dorsum green, replaced by yellow on joints 5, 6, 10 and 11; lateral region whitish. An elliptical white spot subdorsally between the horns of joints 11 and 12. The spines on the horns and skin spinules essentially as in the mature larva, the latter passing on to the horns where they become elongated into short spines. Width of the head .7 mm. (calculated .72 mm.). Length of the larva 3 to 5.5 mm.

Stage V.—Horns shorter than before at first, but they grow considerably during the stage, spines longer; the rudimentary horns on joints 6 to 10 smaller. Armature essentially as before. Color essentially the same. Horns on joints 3 and 4 flesh-colored, subdorsal on joints 5 and 11 dark purple brown, this color covering joints 3 to 5 as far as the lateral horns and joint 11 below the subdorsal horn and the dorsal patch on joints 7 to 9, which is bordered as before. A yellow dorsal spot between joints 6 and 7, and 9 and 10; a distinct round yellow dorsal spot on joints 5 and 12, a white subdorsal patch on joint 12 as before. The rest of the dorsal and lateral areas bright yellowish green, the lateral ridge and subventral area colorless. Two intersegmental lateral depressions can now be distinguished beside the dorsal ones. Subdorsal horns on joints 12 and 13 colorless like the lateral ones, above which a straight white line is separated from the green lateral area by a dark transparent line. A faint white line on the subventral ridge. Width of the head 1 mm.; length of the larva 5.5 to 9.5 mm.

Stage VI.—(Plate I, figs. 17 and 18). Similar to the preceding. Patches over the large horns and adjacent, brown, shading darker at the edges; the anterior one covering the lateral horns, the posterior the subdorsal horns on joint 11 and surrounding the white patch between joints 11 and 12; a small dorsal linear spot on joint 4, a round one on joints 5 and 11, yellow. Green dorsal blanket-like patch reaches to the lateral horns extending over joints 6 to 10 and running back laterally beneath the subdorsal horns to end in a point on joint 12. It is edged with black and white in the following manner: A subdorsal crimson brown dash on joints 6 and 10, a dusky band above the lateral horn; central elliptical patch crimson brown, blackish at the edge, then crimson, bordered with white and laterally by a crimson brown line. Between the subdorsal horns of joints 11 and 12 a large rounded pentagonal white spot. Horns on joints 3 and 4 fleshy brown, the subdorsal on joints 5 and 11 purplish brown, 3.5 to 6 mm. long, the rest colorless. Body rounded rectangular in dorsal aspect, the ends larger than the middle; subdorsal ridge evenly rounded over, lateral ridge prominent, subventral space very small, colorless, a white line along the subventral edge. Depressed areas very small, forming slight hollows, the dorsal and two lateral intersegmental rows present, the rest not distinguishable. Skin smooth to the naked eye, under a strong lens seen to be densely covered with pointed conical skin spines, dark or colorless according to the ground color, elongated on the horns. Spines stiff, straight and smooth, black tipped, reddish on the long horns, colorless

on the short ones. Width of the head 1.4 mm. (calculated 1.47). Length of the larva 9.5 to 13 mm.

Stage VII.—As in the preceding stage. Stage VII differs from the last stage (VIII) as follows: The horns are longer (compare figs. 10 and 9) and their skin spines shorter (Plate I, figs. 22 and 13). The purple brown color is less extensive, being absent from the subventral area and the posterior end of the body, confined to the regions described above, and its tint is rather paler. The patches of "caltrope" spines are present, but smaller than in the last stage and there are no tufts of detachable spines. The long horns grow from 3.5 mm. to 5.8 mm. during the stage and are suddenly shortened to about 2 mm. at the last molt. Width of the head 2 mm.; length of the larva 13 to 18 mm.

Stage VIII.—(Plate I, fig. 16). Head beneath joint 2, but 2 not beneath 3; joints 3 and 4 somewhat folded. Dorsum rises nearly perpendicularly in front, rounds over at joint 5, slopes gently and slightly to joint 11, and is then nearly perpendicular to the anus. No subdorsal ridge, the body evenly rounded, the sides almost perpendicular. On joints 3, 4, 5 and 11 a pair of suborsal fleshy processes, furnished with long stiff spines, salmon colored with black tip (Plate I, fig. 4); among them a very few spatulate setae (Plate I, fig. 14). The processes on joints 3 and 4 are short, those on joints 5 and 11 long (2 to 3.5 mm.), on joint 12 small and still smaller on joint 13. A similar lateral row on joints 3, 4, 6 to 12, all short. On joint 12, above the lateral process, and on 13 anterior to it, is an elevated velvety brown spot, composed of closely set, detachable spines (Plate I, figs. 7, 23 and 24; fig. 8 shows the appearance of the skin after these spines are detached). These spines have a pale yellowish shaft and brown-black tip. Body smooth to the naked eye, under a lens finely spinulose (Plate I, figs. 11, 12 and 13) with paired dorsal and two lateral rows of intersegmental shallow pale-colored pits. Color dark purplish vinous; a pale yellow, elliptical spot dorsally on joints 5 and 11, edged with blackish; a much larger similarly colored one on each side subdorsally behind the large horn on joint 11; a large bright green patch covers the back and sides of joints 6 to 10 like a blanket, extending on joints 11 and 12 laterally, and leaving an elliptical patch of the ground color dorsally on joints 7 to 9 like a hole in the blanket. The blanket patch is narrowly edged with black and broadly with white. Head pale greenish, eyes black, mouth brown; width 3 mm. The anterior edge of joint 2 bears many setæ, and there is a group of them before the spiracle. Cervical shield a skinny area with a few punctures on its anterior border, square behind,

the anterior corners cut off, 2 mm. wide. A fold runs across joint 2 obliquely from the anterior corner of the cervical shield backward above the spiracle. Two hairs subventrally (iv + v) on every segment except joint 2. Thoracic feet small, colorless, with a terminal brown claw. About eight setae on the suranal lobe and seven on each paranal lobe, the latter not different from those just assigned to the subventral row. Subdorsal tubercules represented by tiny spines on joints 6 to 10, as in the previous stage. On the upper side of the lateral horns on joints 6 to 11, near the tip, are a series of patches of minute detachable spines, designated "caltropes" by Dr. Packard. (Plate I, fig. 5.) A few are also found among the detachable spines at the end of the body, but of a somewhat different shape. (Plate I, fig. 6.) The length of these "caltropes" is about .07 mm. Length of the larva 16 to 23 mm.

Cocoon.—(Plate I, fig. 19). With the characters of the group.

EXPLANATION OF PLATE I.

(*Sibine stimulea.*)

1. Larva in stage I, enlarged.
2. End of stage III, a diagram showing the genesis of the markings of the central dorsal area.
3. A horn of stage I, 175 diameters.
4. A permanent spine (seta) of a long horn × 50.
5. A "caltrope" from a lateral horn × 175.
6. A "caltrope" from among the detachable spines × 175.
7. A detachable spine × 50.
8. Skin after the removal of the detachable spines × 175.
9. Diagram of front view of larva, stage VIII.
10. Diagram of front view of larva, stage VII.
11. A seta of the rudimentary subdorsal horn of joint 8 with the adjacent skin spines × 50.
12. The same region × 175, showing the skin spines enlarged.
13. The skin spines on a horn × 175.
14. A solitary spatulate seta from the end of the subdorsal horn of joint 5 × 175.
15. *Sibine stimulea.*
16. Mature larva.
17. Larva stage VI, natural size.
18. The same, dorsal view.
19. Cocoon.
20. A group of eggs as laid on the leaf.
21. Feeding traces of the larva at the first period of eating.
22. The skin spines on a horn, penultimate stage × 175.

23, 24. Base and apex × 175 of the spine shown in fig. 7.

Figures 15 to 21 by Miss Morton, the rest by Dr. Dyar.

SYNOPSIS OF THE SPECIES OF NYSSON INHABITING AMERICA, NORTH OF MEXICO.

By WILLIAM J. FOX.

Handlirsch's monograph of this genus is, unfortunately, as far as the American species are concerned, not as complete as his papers on the allied genera. This is accounted for by the scarcity of American material at his command, he having had but eight of the twenty-one species then known from this region, two of which were described by him for the first time. This lack of material probably accounts for the absence from his paper of synoptic tables of our species; and it is hoped the present paper will remedy this want. To be sure, our species were tabulated by Cresson in 1882, but as our knowledge of characters, both specific and sectional, has been increased since then, the present paper can hardly be considered superfluous.

The Tribe Nyssonini consists of the genera *Alyson*, *Didineis* and *Nysson*, of which the two former were tabulated in 1894 *

FEMALES.

1. Hind tibiæ more or less serrated 2
   Hind tibiæ not serrated 4
2. Metanotum (postscutellum) bilobate; size rather large; abdomen black, with yellowish maculations 3
   Metanotum without lobes; size small; first two segments of abdomen red. **solani.**
3. Legs red ..... **texanus.**
   Legs black ..... **fuscipes.**
4. Submedian (anal) cell of hind wings terminating somewhat beyond, or at the origin of the cubital vein 5
   Submedian cell of hind wings terminating before the origin of the cubital vein 11
5. Scutellum margined, though not strongly, at the sides, covered with large, sparse, shallow punctures (spots on first abdominal segment largest) 6
   Scutellum not margined at the sides, strongly, and usually closely punctured. 8
6. Second ventral segment at the base truncate, viewed from the side almost forming a right angle ..... **spinosus.**
   Second ventral segment otherwise formed 7
7. Pygidial area broad, subtruncate at tip, with large, somewhat confluent punctures; lateral spots of first dorsal segment covering almost the entire segment ..... **plagiatus.**

* Entomological News, VII.

Pygidial area narrower, rounded at tip, longitudinally rugoso-punctate; lateral spots of first dorsal segment confined to apical portion of the segment, transverse ..... **æqualis.**

8. Clypeus bituberculate at apex; punctuation of the head and thorax very coarse, almost rugose (medial and hind femora more or less red) .... **compactus.**

Clypeus not tuberculate; punctuation strong, but rather close and not rugose. 9

9. Abdomen not at all red 10

Abdomen with the two basal segments more or less reddish (punctuation of head and thorax very close, appearing granular; punctuation of abdomen subtile). **rusticus.**

10. Punctuation of head and dorsulum distinctly separated, that of the abdomen strong and very distinct ..... **lateralis.**

Punctuation of head and dorsulum, particularly the former, very close, that of abdomen rather subtile, most distinct on first segment..... **fidelis.**

11. Scutellum distinctly margined laterally..... 12

Scutellum not margined laterally 15

12. Abdomen not at all reddish..... 13

Abdomen reddish basally..... 14

13. Basal enclosure of middle-segment with coarse, irregular ridges, thereby making the enclosure reticulate; abdominal punctures strong, but not very deep. **opulentus.**

Basal enclosure of middle-segment with the ridges regular, longitudinal on basal two-thirds, then oblique; abdominal punctures deep..... **mellipes.**

14. Scutellum coarsely rugoso-punctate; wings clear; a yellow line on pronotum and scutellum ..... **bellus.**

Scutellum with coarse, longitudinal folds; wings subfuscous; no yellow on pronotum or scutellum (punctuation of head and dorsulum unusually coarse). **basilaris.**

15. Black, with pale markings; a divided tubercle between the ocelli; punctuation of head and thorax strong and separated ..... **albomarginatus.**

Black, with abdomen red; space between ocelli not tuberculate; punctuation of head and thorax very close and rather fine..... **bicolor.**

MALES.

Hind tibiæ more or less serrated; last dorsal segment 4 dentate 2

Hind tibiæ not serrated; last dorsal bidentate 3

2. Legs red ..... **texanus.**

Legs black ..... **fuscipes.**

3. Second ventral segment truncate at base, viewed from the side almost forming a right angle..... **spinosus.**

Second ventral segment otherwise formed..... 4

4. Submedian cell (anal area) terminating beyond or at the origin of the cubital vein 5

Submedian cell terminating before the origin of the cubital vein 13

5. Last dorsal segment ciliated between the teeth 6

Last dorsal segment not ciliated between the teeth..... 7

6. Last dorsal segment not prominent between the teeth, subtruncate; lateral spots on first dorsal segment large, covering almost the entire segment. **plagiatus.**
Last dorsal segment prominently angulate between the teeth; spots on first segment transverse, confined to apical portion of segment ..... **æqualis.**
7. Clypeus bituberculate at apex; punctuation of head and thorax very coarse almost rugose (hind femora, in part, reddish) ..... **compactus.**
Clypeus not tuberculate at apex 8
8. Abdomen not at all reddish 9
Abdomen reddish basally (clypeus and scape beneath yellow; abdomen with sparse, shallow punctures) ..... **rusticus.**
9. Apical antennal joint scarcely enlarged or curved, obtuse at apex, the preceding joint not produced at apex beneath (tegulæ black; dorsulum rugosely punctured; punctures of abdomen distinct but feebler than in *lateralis*). **simplicicornis.**
Apical antennal joint enlarged, strongly curved, truncate at apex, the preceding joint produced somewhat beneath at apex 10
10. Clypeus and scape yellow (punctures of abdomen rather subtile) 11
Clypeus black 12
11. Antennæ short, stout, when stretched back not reaching the tegulæ; form rather robust, tegulæ dark ..... **tristis.**
Antennæ longer, slenderer, when stretched back reaching, or almost reaching, the tegulæ; form narrower; tegulæ pale-testaceous, or with a yellow spot. **fidelis.**
12. Abdomen with unusually strong punctures, those of the front distinct and separated; scutellum marked with extremely large, sparse punctures. **lateralis.**
Abdomen subtilely punctured; punctuation of front close, so that it has a granular appearance; scutellum coarsely rugose ..... **subtilis.**
13. Apical antennal joint obliquely truncate at tip, more or less curved 14
Apical antennal joint rounded at tip, or obtusely truncate, not or scarcely curved; markings white; first segment with a continuous fascia. **albomarginatus.**
14. Abdomen not all reddish, legs reddish testaceous; enclosure of the middle segments with its ridges evenly spaced ..... **mellipes.**
Abdomen reddish basally; coxæ, trochanters and femora black, tibiæ and tarsi pale ..... **pumilus.**

1. **Nysson texanus** *Cress.*

Nysson texanus CRESSON, Tr. Am. Ent. Soc. IV, p. 223, ♂ ♀.
Paranysson texanus CRESSON, ibid. IX, p. 273.
Nysson texanus HANDLIRSCH, Sitzb. Akad. d. Wissensch. Wien, Math. Naturw. Classe, I Abth. XCV, Bd. p. 297.

Texas, Nebraska; Montana; Lewiston, Idaho (Aldrich); Las Cruces, New Mexico (Cockerell). Recorded by Handlirsch from Georgia and South Carolina.

2. **Nysson fuscipes** *Cress.*

Paranysson fuscipes CRESSON, Tr. Am. Ent. Soc. IX, p. 274, ♂ ♀.
Nysson fuscipes HANDLIRSCH, l. c. p. 301; pl. 4, f. 23.

Washington; Oregon; California. As pointed out by Handlirsch, this species seems confined to the extreme Western States, in fact, those bordering on the Pacific Ocean.

3. **Nysson solani** *Ckll.*

Nysson solani COCKERELL, Tr. Am. Ent. Soc. XXII, p. 294, ♀.

Las Cruces, New Mexico (Cockerell). This species has the hind tibiæ serrated, agreeing in that respect with the two preceding species, but the metanotum is not lobed. It seems to be isolated from the other species as far as its relationship is concerned. The only known specimen lacks the second (petiolated) submarginal cell, which deficiency I consider to be but an anomaly.

4. **Nysson spinosus** *Forster.*

Sphex spinosa FORSTER, Novæ Species Insect, p. 87.
Nysson spinosus HANDLIRSCH, l. c. p. 337, pl. IV, f. 5, 17, 25–28, pl. V, f. 11. ♀ ♂. (For full synonymy see this work.)

North America (Handlirsch). I have only seen European specimens for which I am indebted to Herr F. F. Kohl, of Vienna.

5. **Nysson plagiatus** *Cress.*

Nysson aurinotus PACKARD (non Say), Proc. Ent. Soc. Phila. VI, p. 440, ♂
Nysson plagiatus CRESSON, Tr. Am. Ent. Soc. IX, p. 276, ♂ ♀; HANDLIRSCH, l. c. p. 348, pl. 4, f. 11, 21, pl. 5, f. 10.

Illinois; Indiana; Louisiana (Handlirsch); Texas; Washington. Our largest species.

6. **Nysson æqualis** *Patt.*

Nysson æqualis PATTON, Can. Ent. XI, p. 212, ♂; HANDLIRSCH, l. c. p. 350, pl. 4, f. 10, 22, ♀ ♂.

Massachusetts (Patton); Camden County, New Jersey (in July); Baltimore, Maryland, and South Carolina (Handlirsch); Georgia, Illinois.

7. **Nysson aurinotus** *Say.*

Nysson aurinotus Say, Boston Journ. Nat. Hist. I, p. 368; HANDLIRSCH, l. c. p. 353, ♂, pl. 5, f. 13.

Indiana (Say); Illinois (Handlirsch). Unknown to me.

8. **Nysson Frey-Gessneri** *Hdl.*

Nysson Frey-Gessneri HANDLIRSCH, l. c. p. 355, ♂, pl. 5, f. 12.

Georgia (Handlirsch). Unknown to me.

9. **Nysson compactus** *Cress.*

Nysson compactus CRESSON, Tr. Am. Ent. Soc. IX, p. 278, ♀ ♂.

Washington State.

10. **Nysson tristis** *Cress.*

Nysson tristis CRESSON, Tr. Am. Ent. Soc. IX, p. 281, ♂.

Washington State.

11. **Nysson lateralis**, *Pack.*

Nysson laterale PACKARD, Proc. Ent. Soc. Phila. VI, p. 440, ♂.
Nysson lateralis PATTON, Can. Ent. XI, p. 213, ♀.

Canada (Provancher); Maine, New Hampshire, Virginia, Illinois (Patton).

12. **Nysson subtilis**, sp. nov.

♂.—Cheeks margined posteriorly beneath, coarsely punctured; front closely punctured, appearing strongly granular, feebly ridged above antennæ; between ocelli flat, not tuberculate; clypeus strongly punctured, transversely depressed before apical margin, the latter subtruncate; antennæ stout, scape shining, strongly punctured, flagellum opake, the last joint curved, nearly as long as the three preceding united, obliquely truncate at tip, preceding joint slightly produced beneath at apex; dorsulum with strong, tolerably well separated, punctures; scutellum rugose, no margined laterally; mesopleuræ strongly rugoso-punctate; middle-segment with the spines sharp, slenderer than in *lateralis*, enclosure longitudinally and somewhat irregularly ridged; hind tibiæ not spinose; wings subhyaline, nervures dark, petiole of second submarginal cell a little shorter than the height of cell, submedian cell of posterior wings terminating a little beyond the origin of the cubital vein; punctures of abdomen subtile, much feebler than in *lateralis*, stronger on first segment, second ventral strongly convex, particularly toward the base, but not truncate anteriorly, last dorsal bidentate as in the allied species. Black, the tubercles, and a transverse spot at each side of the first three dorsal segments, yellow; tarsi and anterior tibiæ in front, testaceous; clypeus and anterior orbits with silvery pubescence. Length 6½ mm.

Algonquin, Illinois (Nason). Easily distinguished by the entirely black front and subtile punctuation of the abdomen.

13. **Nysson rusticus** *Cress.*

Nysson rusticus CRESSON, Tr. Am. Ent. Soc. IX, p. 283, ♂ ♀.

Washington; Moscow, Idaho (Aldrich); Colorado.

14. **Nysson nigripes** *Prov.*

Nysson nigripes PROVANCHER, Add. Hym. Quebec, p. 269, ♂.

Hull, Canada (Provancher). Unknown to me. Placed near *rusticus* provisionally, as it may belong elsewhere.

15. **Nysson rufiventris** *Cress.*

Nysson rufiventris CRESSON, ibid, p. 283, ♀.

Montana; Colorado.

16. **Nysson fidelis** *Cress.*

Nysson fidelis CRESSON, ibid, p. 282, ♀ ♂.

Montana; Colorado.

17. **Nysson simplicicornis,** sp. nov.

♂.—Cheeks not margined posteriorly beneath, rather finely punctured; front with distinct, somewhat separated and strong, punctures, slightly prominent above the antennæ; between ocelli flat, not tuberculate; clypeus transversely depressed before apical margin, which is subtruncate; antennæ slenderer than in the allied species scape shining, punctured, flagellum opaque, the apical joint not curved or enlarged, obtuse at tip, the preceding joint not at all produced at apex beneath; dorsulum with coarse shallow punctures, or rugoso-punctate; scutellum coarsely punctured, not margined laterally; mesopleuræ coarsely punctured but less so than the dorsulum; middle segment with the spines sharp, slender, enclosure irregularly ridged; hind tibiæ not spinose; wings sub-hyaline, nervures and stigma black, petiole of second submarginal cell shorter than the height of cell, submedian cell of posterior wings terminating at the origin of the cubital vein, punctures of the abdomen distinct, finer and closer, however, than in *lateralis*, second ventral segment strongly convex, with the punctures sparser, last dorsal bidentate. Black; spot at apex of four anterior femora beneath and on dorsal segments 1–3, whitish; mandibles reddish medially; tarsi somewhat testaceous; clypeus and sides of face with dense silvery pubescence. Length 5 mm.

Ingham County, Michigan (G. C. Davis), July 17th. Smaller than the allied species with black abdomens and is at once separated by the different terminal antennal joint.

18. **Nysson opulentus** *Gerst.*

Nysson opulentus GERSTÄCKER, Abh. Naturh. Gesell. zu Halle, X, p. 114, ♂

Nysson opulentus CRESSON, Tr. Am. Ent. Soc. IX, p. 279. ♀.

Nysson opulentus HANDLIRSCH, l. c. p. 357, ♀ ♂.

New York. The ♂ I have not seen.

19. **Nysson mellipes** *Cress.*

Nysson mellipes CRESSON, Am. Ent. Soc. IX, p. 279, ♂ ♀.

Colorado; Dakota; Montana.

20. **Nysson tuberculatus** *Hdl.*

Nysson tuberculatus HANDLIRSCH, l. c. p. 363, ♂ ♀.

Wisconsin and South Carolina (Handlirsch). Unknown to me. It is said to be close to *basilaris*, but seems to differ somewhat in the punctuation of abdomen, greater extent of black on legs and presence

of pale spots on scutellum. I am inclined to regard *basilaris* and *tuberculatus* as synonymous, however.

21. **Nysson basilaris** *Cress.*
Nysson basilaris CRESSON, Tr. Am. Ent. Soc. IX, p. 281, ♀.
Georgia.

22. **Nysson bellus** *Cress.*
Nysson bellus CRESSON, ibid. p. 280, ♀.
Montana and Texas.

23. **Nysson pumilus** *Cress.*
Nysson pumilus CRESSON, ibid. p. 405, ♂.
Nevada.

24. **Nysson albomarginatus** *Cress.*
Nysson albomarginatus CRESSON, ibid. p. 278, ♂ ♀.
Nevada. Easily distinguished by the pale, continuous fasciæ of abdomen. The unique ♀ type has also two, tranverse, pale spots on first segment, near base. These may not be constant in a series, however.

25. **Nysson mœstus** *Cress.*
Nysson mœstus CRESSON, ibid. p. 280, ♂.
Washington State.

26. **Nysson bicolor** *Cress.*
Hyponycson bicolor CRESSON, ibid. p. 284, ♀.
Nysson bicolor HANDLIRSCH, l. c. p. 402.
Washington State. The unique type of this species lacks the third submarginal cell.

SOME NOTES ON LOCUST STRIDULATION.

BY A. P. MORSE, Wellesley, Mass.

Every observer of outdoor Nature is familiar to a greater or less extent with the peculiar rattling or crackling sounds produced by certain locusts or "grasshoppers" in flight. When at rest these insects are quite inconspicuous, their colors resembling closely the prevailing tints of their surroundings, but when in flight many of them attract notice not only by their stridulation, but also by their strikingly colored wings in which yellow and red with black markings predominate.

These locusts belong to a group, the Œdipodinæ, usually given subfamily rank, of which fifteen species are found in New England. One of the best known and most widely distributed of these in eastern North America is a species whose wings are black with a pale buff outer border and with a few spots at the tip; this is the Carolina locust. It is very common on dusty roadsides and waste places in the latter part of summer and the early autumn. Owing to the prevailing tint of quiet brown which clothes the majority of individuals they are known in some localities as "Quakers."

Just how the rattling sound is produced is a matter of some speculation; it is, however, entirely under the control of the insect, which can produce it or not at will. So far as recorded, only the male stridulates, though I suspect that the females of some species occasionally do in a less degree. Owing to the noise being produced in flight it is difficult not only to observe the exact method of its production, but also to determine with certainty that it is confined to one sex. It is usually stated to be caused by the striking of the front edge of the wing against the under side of the wing-cover. This might occur as the result of an up-and-down blow or, as I venture to suggest, of a slight antero-posterior movement bringing the prominent veins of the under side of the wing-cover (humeral trunk and ulnar or anal veins) into collision with the raised veins of the base of the wing.

Certain species, however, produce not only rattling, but distinct snapping sounds consisting of separate loud snaps or clacks, *e. g.*, *Circotettix verruculatus*, which often dances up and down in the air while doing so and not infrequently ends its powerful and erratic flight with a rattle immediately before alighting. It has seemed to me that the clacks may be produced in a different manner from the rattling sounds, and the following is suggested as a possible explanation.

If the wing-cover of any of our larger Œdipodinæ be examined there will be readily seen near its point of attachment, about in its midline, between the bases of two of the conspicuous veins (humeral trunk and anal) and pressing them apart, as it were, a distinct prominence. From this spring the two ulnar veins. If the wing-cover be inverted a depression will be found corresponding to the external prominence. In this depression lies the elevated base of the median vein of the wing when the wings and wing-covers are closed, and this arrangement holds these organs in place in the position of rest without any direct effort of the insect. If the wing-cover of a newly killed or relaxed Œdipodine be properly manipulated it will leave its place with a distinct snap, due

to the sudden slipping off of the base of the wing-cover from the base of the wing. This arrangement is highly developed in the genus *Circotettix*, whose members are noted for the clacking noise produced in flight, which it seems to me may perhaps be thus produced by the sudden, and more or less rapidly repeated, opening and closing of the flight-organs.

There is another group of locusts found with us, fewer in species, smaller in size, and of less conspicuous habits, but more plentiful in numbers than the Œdipodinæ, which stridulate not during flight, but when at rest,—these are the little oblique-faced Tryxalinæ. In this group the sound is produced by rubbing the hind thighs against the wing-covers, and both the apparatus and its working are readily observed. It consists, in most of our species, of a row of fine teeth projecting from the inner side of the hind thighs of the male in such a position as to engage the elevated veins of the basal part of the wing-covers, by this means setting up vibrations in the latter. This may be readily demonstrated in the fresh insect or a relaxed specimen. The sounds produced in this way are entirely different in character from those made by the Œdipodinæ in flight, being a scraping or scratching, as distinguished from a rattling, crackling, or rustling.

There is, however, a genus (*Mecostethus*) of this group which is allied to the Œdipodinæ in structure, and the males of one of its species produce the loudest note made by any of our Tryxalinæ. In this genus the hind thighs of the males are destitute of teeth, which are borne instead upon a supernumerary vein of the wing-covers, which is raised above the others. In the species referred to the teeth on this vein are high and very acutely pointed.

This additional vein is found in all our representatives of the Œdipodinæ, which stridulate in flight, and the discovery of this arrangement of the apparatus in *Mecostethus* led me to examine this vein in several species of Œdipodinæ to see whether it was ever supplied with a rasping surface; for if so, these locusts also could doubtless stridulate when at rest. It was found in several species to be provided with teeth of different degrees of effectiveness, and not long afterward I was enabled to witness the use of this form of stridulating apparatus by an Œdipodine.

While walking up the Mt. Washington carriage-road one bright morning in early September I came upon a group of several males of *Circotettix verruculatus* sunning themselves by the roadside in the shelter of an overhanging cliff. The night had been quite cool and

they had evidently but just become sufficiently warmed by the morning sun to take an active part in life, and in consequence allowed a closer approach than is the usual custom of this wary species. Two of them seemed more wide awake than the others, and as they crawled about would occasionally stop, slightly elevate the hinder part of the body and rapidly move the hind thighs up and down against the wing-covers, producing a distant "scritching" sound clearly audible at a distance of three or four feet. This act was repeated several times at intervals of a few seconds. No females were seen near by.

Desiring to make further observations on this mode of stridulation in the Œdipodinæ I secured one day after my return several examples of *Encoptolophus sordidus* and *Arphia xanthoptera* and enclosed them, together with some grass, in a pasteboard box of about a cubic foot capacity, covered it with netting and placed it in the sun. Both sexes of both species were represented, but of females there were but two of each.

At first their efforts were entirely in the direction of escape, but after a short time they became more quiet and were left by themselves, an occasional approach being made to see how matters stood. Nothing of interest was learned from the Arphias, but after some time two males of *E. sordidus*, oblivious to their surroundings, became attentive to one of the females. Aroused by her near presence they crawled rapidly about, and as they approached her would stop, stridulate for a second with their hind thighs, and excitedly leap toward or upon her, when, being repulsed, they would repeat the operation. The sound produced was a very high-pitched "ĭ′chĭ-ĭ′chĭ-ĭ′chĭ-ĭ′chĭ."

Another sound of an entirely different character was made by them in a different manner. The hind thighs, instead of being closely applied to the wing-covers, were spread somewhat apart and violently vibrated, moving, as nearly as could be judged, up and down with extreme rapidity and striking as they did so upon the bottom of the box. The sound produced was a peculiar "r-r-r-rd" or "r-r-r-rt," low in tone and of considerable volume, leading me to think from its quality that it was due in part to the vibration of the pasteboard bottom. Once it seemed as if the wing-covers took some part in it, vibrating laterally; but as the act was witnessed but twice, both times from the side, and was too rapid for the eye to follow, I am uncertain of the exact method of its production.

Lack of time in suitable weather prevented further observations, but these are reported in the hope of bringing out information on the subject and inducing other observers to pay some attention to this interesting habit.

The occurrence in the Œdipodinæ of stridulation when at rest seems to have been entirely overlooked in late years, though observed by Yersin in *Œd. fasciata*. Among the Acridinæ *Caloptenus italicus* and *Melanoplus femur-rubrum* have been observed by Yersin and Scudder respectively to perform the stridulatory movements, though no sound was noted in either case. Yersin was disposed to believe that all locusts provided with well-developed wing-covers execute such movements, whether accompanied by sound or not. And it is not unlikely that sound is often produced too faint or fine for our ears to perceive.

Nothing is known of stridulation in the Tettiginæ, but it seems possible that it may occur in the same manner, *i. e.*, by friction of the hind thighs on the side of the pronotal process or anterior edge of the wing which in this group take the place of the wing-covers. In the Eremobinæ *both* sexes are said by Saussure to be often provided with special musical apparatus of two kinds, one used at rest and one in flight and both differing from those here mentioned.

BOTH SIDES OF BUTTERFLIES.

By A. P. MORSE, Wellesley, Mass.

Every collector of butterflies and every student of variation in these insects is interested in methods whereby both surfaces of the wings of his favorites can be studied with a minimum amount of labor and inconvenience. Book-boxes, so-called, with glass top and bottom and cork gummed to the glass, answer very well in a permanent collection, but for one which is receiving additions and to whose owner expense is an item to be closely considered, so that an entire case or cases cannot be given up to a species, some method is necessary which will more readily permit of rearrangement when desired. With this end in view I several years ago designed the following plan, which is here presented in the hope that it will be of interest or use to others. While metal strips filled with cork have been used for some time I believe that the method of rearrangement suggested is entirely novel.

The cases for which the plan was designed are of the standard museum pattern, 16 x 19 x 3 inches outside, 15 x 18 inside measurement, the top and bottom of glass, the sides of wood joined by tongue and groove, the tongue being either of wood or metal. The plan, however, is applicable to almost any form or size of case preferred. Aside from

its increased weight a glass bottom, as well as top, is to be preferred for all cases of considerable size, as it does away with the troublesome shrinking which is inseparable from the use of large sheets of wood unless made in three-ply, as in the manufacture of desks, etc.

The method is this: Procure twice as many thin strips of some straight-grained wood with as little tendency to warp as possible, such as cherry or basswood, one-quarter inch in thickness, as long as the inside measurement of the front of the case and as wide as the case is deep inside. On one side of these strips are sawed, with a fine saw, slots one-fourth inch in depth at intervals of half an inch. Two strips will be needed for each case (front and back), making twice as many strips as cases, one-half of which should have the first slot sawed at a distance of one-half inch from the end, the other half at a distance of three-quarters inch; the reason for this will be seen later. These strips may be procured at slight expense from the maker of the cases or a box manufacturer.

Next, get a reliable tinsmith to cut some strips of tin three-quarters inch wide and fourteen and seven-eighths inches long and bend them up into troughs one-fourth inch wide and deep with vertical sides. To one side of each end of a trough should be soldered neatly the short end of an L-shaped piece of the same material one-fourth plus three-fourths inch long and nearly one-fourth inch wide. These lie flat upon the bottom of the case out of sight beneath the wooden strip and act as feet to hold the trough upright during rearrangement. To give as much supporting surface as possible they should be attached to opposite sides of the trough. The portion of the side of the trough opposite the attached piece should be cut through and turned down flat, widening the supporting base, or it may be removed entirely, leaving the end of the trough with a single vertical edge which fits into the slots sawed in the wooden strips. These edges being on opposite sides of the trough necessitate the different position of the slots on the front and back strips previously mentioned. The troughs are then to be filled with strips of cork and the whole to be painted over a dead white or black as preferred. The tin troughs ready to be filled may be obtained for about three cents apiece, in lots of one hundred or more.

The troughs are held in position by the slots sawed in the wooden strips and may be placed within an inch of each other, or within one-half inch in the case of very small specimens by cutting a little off the ends of the L-shaped feet, or as far apart as desired. The wooden strips are held in place at front and back of the case by short, headless

pins or brads thrust into the sides of the case, and if equal in width to the depth of the case are held down by the cover, or they may be narrower and then held securely in place by a pin above each end.

For examination the case may be placed upon a table covered with white or dark cloth or paper according to the background desired, and may be instantly turned upside down, allowing both sides of the entire series of specimens to be examined when desired without a moment's delay.

A NEW GLOVERIA.

By HARRISON G. DYAR.

Mr. L. O. Howard has sent me several examples of a Lasiocampid collected in Arizona for the Department of Agriculture, which seems to represent an undescribed species. I take pleasure in dedicating it to this well known entomologist.

Dendrolimus howardi, sp. nov.

Female. Like *Quadrina diazoma*. Clay color (Ridgway, pl. V, fig. 8) irrorate with pale chocolate brown scales. Two faint, brown, nearly straight lines, one across the cell, the other at the outer third of the wing, the most distinct mark. A very faint white discal dot. Subterminal line irregular, broken, faint, twice outwardly curved, at veins 3 and 4 and 6 to 8. Secondaries and thorax pale brown, about the tint of the transverse lines of the primaries; abdomen a little paler. Expanse 49 to 66 mm.

Male. Considerably like the male of *D. gargamelle* Strecker (The male of *Q. diazoma* being unknown). Sepia (Ridgway, pl. III, fig. 3), along the outer margin of primaries succeeded by a semi-transparent zone, which shades into raw umber (R. III, 14) over the basal half of the wing, composed of brown and yellowish hairs. Discal dot round, distinct, white. Lines as in the female, faint, darker than the wing, the subterminal especially obscure, broken into a series of brown intervenular dots, the one at the anal angle the most distinct. Secondaries sepia, a semitransparent space covering the outer third except for a narrow outer margin. Body dark, mixed with yellowish hairs. On the primaries the subterminal line is much fainter than in *gargamelle:* the transverse space encroaches on it whereas in *gargamelle* it just reaches the line. Basally in both it reaches to the discal dot. The bright yellowish costal shade is not present in *gargamelle.* The secondaries e dark chocolate, not bright reddish brown; the transparent space reaches out urther than in its ally, leaving only a narrow band instead of an outer third. Expanse 38 to 45 mm.

The types are three pairs in the National Museum and one pair in my collection. All bred specimens.

In markings the female is perhaps not different from *Quadrina diazoma.*

Grote, the type of which is rubbed and the faint transverse anterior line and discal spot may have been obliterated, not being mentioned in the description. The wings are, however, clearly not short and broad as described (and as shown also in the photograph before me); but are, as usual, rather long, the outer margin gently convex. The size, too, is much smaller; but the specimens may have been reduced by breeding, although Mr. Howard does not think that this can be the case to any great extent. Otherwise this form is distinct from any in our fauna, nor is there anything like it in the Biologia Centrali-Americana. Mr. Druce and Mr. Schaus have both described several Lasiocampids since the date of the Biologia; but a perusal of their descriptions does not suggest that any of them have to do with the present insect.

Synopsis of the American Dendrolimus ♀ ♀.

Gray, the subterminal line distinct.
Subterminal line sharply and regularly dentate..... .....**arizonensis.**
Subterminal line undulate, irregular..... .....**dolores.**
Brown-gray to yellowish brown, subterminal line obscure.
Dark grizzled gray brown, discal dot white.....**gargamelle.**
Paler, luteous brown, only traces of discal spot.
Wings as usual, rather elongate..... .....**howardi.**
Wings short and broad, depressed at apices.....**diazoma.**

The following notes, sent me by Mr. Howard, show the dates observed for the emergence of the moths as bred at Washington.

"April 10, 1895. Received from J. W. Toumey, Tuscon, Arizona a web of a Lasiocampid and some partly grown larvæ found feeding on *Quercus emoryi;* only observed on a few trees. Accompanying them was a strip or band of web taken from the tent. Mr. Toumey has been informed that great bands of such web hang from the branches immediately around the tent like long streamers.

The larvæ are bright ferruginous with a yellowish lateral stripe and dull black head.

There are three median dorsal rows of white soft hairs and a lateral row of same color.

April 20th. Larvæ are feeding both on buds just opening as well as on the dry leaves of oak. One tachinid fly issued; it is *Exorista thlecarum.*

July 1st. One larva spun up.

July 10th. One moth, a female issued.

July 16th. Five males issued; two were ruined, the remaining three spread.

July 18th. One female issued; left in cage to copulate.

July 19th. Two females and four males issued. Eggs were deposited in the cage.

July 22d. Three females and five males issued. Two more batches of eggs deposited.

July 23d. Three females and two males issued.

July 24th. One female and one male issued. More eggs were deposited.

July 25th. Two males issued.

July 26th. One female issued.

July 29th. Two issued. (Sex not stated.)

August 2d. Two issued.

August 5th. One female issued. Some of the eggs hatched.

August 8th. One male issued.

August 9th. More larvæ hatched."

The following descriptions have been drawn up from alcoholic specimens preserved at the Department of Agriculture, some of which have been kindly presented to me by Mr. Howard.

Eggs.—Oval; one end bluntly rounded, the other conical, slightly flattened above and below. Pure white, very slightly shining, a small, round, yellowish translucent spot in the centre of each flattened side. (The large end is eaten away in all the specimens, by the young larvæ, so I am not able to describe the micropylar region.)

Length 1.8 mm., width 1.5 mm. and 1.4 mm. through the flattened sides. Shell minutely roughened under a half-inch objective, but without marks. Laid in irregular clusters without any covering.

Stage I.—Head and thoracic feet shining black; cervical shield, leg plates and anal plate, as well as a dorsal patch on joint 13, brown black. Body grayish white with a row of subdorsal segmentary orange spots, diffuse and broad. Warts small, black, each with several hairs, fine, spinulated and rather long. Arrangement of the warts normal (Psyche vii, 259), the secondary warts very feebly developed, obscure; warts iv and v also obscure, vi divided. On the thorax the posterior subdorsal wart (iia) is larger than in Clisiocampa and bears several hairs. No secondary hairs. Width of head 1.05 mm.

Stage IV.—Head, cervical shield, joints 12 and 13 dorsally, anal plate and anal feet black; width of head 3.0–3.2 mm. Body gray, mottled with black, defined in a series of subdorsal dots and narrow lateral line, between which runs a broad orange-red band. Hair fine,

white, rather thick, with a series of little short dorsal tufts. Venter dark gray with a series of black medio-ventral spots. Body quite densely clothed with secondary hairs, the warts almost obsolete, some of the largest ones persisting, black. Leg plates dark.

Last stage.—Head black, the lower segment of clypeus, side pieces and median suture whitish; mouth pale; all covered with soft white secondary hairs; rounded, rather large, not retracted; width 5.5 to 6.4 mm. Body curiously transversely streaked with whitish and red-brown, silky hairy, flattened; no warts. There is a rather broad shaded blackish band below the spiracles, relieved by a series of whitish intersegmental patches below, otherwise grading into the dark venter, mottled with black and light red on each side of the median black patches. Above the substigmatal line the marks are transeverse, except a narrow brown-black broken lateral line which cuts them. The ground color is whitish, shading into bright brown subdorsally, with about six obscured transverse streaks of brown black, most distinct intersegmentally. They become clouded in a dark brown shade centrally on the segment and are relieved by an orange subdorsal transverse dash on the posterior third on joints 4 to 12, a rather conspicuous making, defined before by darker brown; an anterior dark brown ad-dorsal patch. These transverse markings are produced by a growth of fine short dark brown secondary hairs in four transverse lines over the dorsum, a broken blackish dorsal and ad-dorsal shading on the ground of the original broad orange-red subdorsal band. At the lower edge of the orange dash a dark red shade obscurely parallels the longitudinal superstigmatal line. Cervical shield velvety black with two white streaks below it. Anal plates black, joint 12 heavily clouded with blackish. Thoracic feet reddish, abdominal dark, with a bright whitish streak down the outer side. Hair soft, fine, white, tufted dorsally and subventrally centrally on the segments. Warts absent, all the hairs secondary; no perceptible enlargement below the cervical shield; joint 12 not enlarged.

The short brown hairs are stiff thick-walled tubes, smooth with pointed conical ends; they are widest at terminal third and taper a little toward the base, minutely granular-roughened just before the tip. The long white hairs are more slender, colorless, thin walled and smooth, gently tapering toward the tip. There is a slight roughening toward the tip of short lamellar points. Length of the short hairs .4 to .6 mm., of the long ones 3 to 6 mm. The short hairs are evidently of a defensive nature as they become detached when the larva is handled and entering the skin produce some irritation and finally small blisters which last for several days.

Cocoon.—Thin, almost papery, of dark brown silk, single, but with some loose silk without; elliptical, less definite in shape than in Clisiocampa, the ends thinner than the central portion. Size 35 x 15 mm.

Pupa.—Robust, the abdomen large, thicker than the thorax, slightly curved ventrally, the anal rounded, pilose, without cremaster, three moveable incisures, viz. 4–5, 5–6, 6–7th abdominal segments (corresponding to joints 8–9, 9–10, 10–11 of the larva) the other incisures behind the 8th abdominal segment distinct, but fixed. Spiracles large, distinct, present on abdominal segments 2 to 8. Cases smooth, compact, firmly united, the joinings marked by darker lines; the leg cases reach to the end of the third abdominal, wing cases to middle of the fourth, antennae cases opposite the end of the fourth segment. Head and thorax pilose, abdomen less distinctly so; cases smooth. Color light reddish brown, the incisures, spiracles and sutures darker. Length 25 mm., width 10 mm.

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By A. S. Packard.

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PRELIMINARY HANDBOOK OF THE COLEOPTERA OF NORTHEASTERN AMERICA.

By H. F. WICKHAM.

(Continued from Vol. III, p. 190.)

Amara *Bon.*

This genus includes those Pterostichini in which the terminal joint of the palpi is not dilated, the labial with the penultimate joint plurisetose in front and longer than the last one. The elytra are without the dorsal puncture. The genus is of great size and offers considerable diversity of form, some of the species resembling *Pterostichus* or *Harpalus*, while the majority have a facies which is unmistakeable. The form of the thorax has served a good purpose in the primary separation into groups, after which secondary sexual characters must be largely relied upon. By the kind permission of Dr. Horn, his synopses and descriptions have been used in this paper (almost without change except in the way of condensation) for those portions of the genus on which he has written. The first part, the subgenus *Lirus*, has been largely taken from the descriptions of Dr. LeConte, who, however, had not tabulated the species. No attempt has been made to disturb the existing status of species, the idea being simply to give a clue to the identification as they now rest. A careful revision of the forms with subcordiform thorax is a desideratum but must be left to those who have access to types.

Synopsis of Species.

1. Thorax broader in front of the base, narrowed posteriorly and usually more or less cordiform 2
   Thorax narrowed anteriorly, broad towards the base or sometimes slightly narrowed in that part 14
2. Posterior tibiæ not pilose internally in either sex 3
   Posterior tibiæ of male densely pilose internally 11
3. Middle tibiæ simple in both sexes 4
   Middle tibiæ of male bidentate internally 6
4. Hind angles of prothorax not carinate 5
   Hind angles of thorax with distinct carina ..... **similis.**

5. Larger (8–10 mm.), elytral striæ distinctly punctured, prothorax punctured from side to side at base ..... **avida.**
Smaller (6 mm.), elytral striæ nearly smooth, thorax not punctured at base. **arenaria.**
6. Thorax sinuate on the sides near base, hind angles rectangular or prominent..7
Thorax not sinuate on sides near base, hind angles obtuse.....9
7. Elytra more parallel, more than three times as long as the prothorax. **rufimanus.**
Elytra more rounded on sides, less shining, less than three times as long as prothorax 8
8. Sides of prothorax more rounded, more suddenly sinuate at base, hind angles rectangular, prominent ..... **laticollis.**
Sides of prothorax less rounded, less suddenly sinuate at base, hind angles rectangular, not prominent .....**carinata.**
9. Thorax nearly quadrate, elytral striæ fine, finely punctate anteriorly..**elongata.**
Thorax broader than long, elytral striation less fine, punctuation quite evident.10
10. Blackish piceous, elytral striæ more finely punctate .....**hyperborea.**
Blackish, elytra brown, striæ more strongly punctate .....**brunnipennis.**
11. Prosternum with side pieces smooth 12
Prosternum with side pieces punctured, scutellar stria long .....**apricaria.**
12. Prosternum ♂ not punctured.....**septentrionalis.**
Prosternum ♂ with oval punctured space.....13
13. Scutellar stria short or wanting, meso- and metasternal side-pieces punctured. **exarata.**
Scutellar stria long, meso- and metasternal side-pieces smooth .....**latior.**
14. Posterior tibiæ of ♂ densely pilose internally 15
Posterior tibiæ of ♂ not or scarcely pilose internally 23
15. Spur of anterior tibia trifid 16
Spur of anterior tibia simple.....17
16. Hind angles of thorax obtuse, four antennal joints largely pale....**angustata.**
Hind angles of thorax sharp, rectangular, only three basal antennal joints pale.....**pallipes.**
17. Antennæ not carinate, prosternum of ♂ not punctured.....18
Antennæ with joints 2–3 carinate.....21
18. Scutellar stria terminating in an ocellate puncture .....**impuncticollis.**
Scutellar stria without ocellate puncture.....19
19. Striæ of elytra punctured, base of thorax finely punctured.....**basillaris.**
Striæ of elytra not or obsoletely punctured, base of thorax smooth.....20
20 Thorax narrowing from base to apex, form broad, robust, terminal spur of anterior tibia shorter than usual.....**crassispina.**
Thorax narrowing from in front of base, form oblong-oval, tibial spur normal, legs piceo-rufous, hind angles of thorax obtuse, the puncture rather distant from side margin .....**cupreolata.**
21. Scutellar stria with ocellate puncture.....**fallax.**
Scutellar stria without ocellate puncture 22
22. Basal impressions of thorax very faint, striæ of elytra and surface of thorax not punctured, form oblong oval .....**protensa.**

Basal impressions of thorax distinct ..... **polita.**

23. Antennæ and legs piceous black. 24
Antennæ pale, legs usually so. 25

24. Elytra with silken lustre, intervals with more or less uneven surface, color variable ..... **interstitialis.**
Elytra shining, intervals flat, even, smooth ..... **erratica.**

25. Prosternum plurisetose at tip; metepisternum longer than wide at base. . **obesa.**
Prosternum bisetose at tip, sides of thorax distinctly deplanate, legs rufo-testaceous; ♂ shining, ♀ opaque ..... **remotestriata.**
Prosternum without setæ, sides of prothorax not deplanate. 26

26. Prosternum of ♂ with a small group of punctures 27
Prosternum of ♂ smooth as in ♀ 28

27. Form rather broadly oval, not twice as long as broad, legs rufo-testaceous. **chalcea.**
Form oblong, twice as long as broad, thorax very broad, legs rufo-testaceous. **gibba.**

28. Sides of thorax oblique behind, apex of scutellar stria united to first. . **harpalina.**
Sides of thorax not oblique behind the middle, scutellar stria free at apex 29

29. Thorax distinctly emarginate at apex, front angles sharply prominent . **subænea.**
Thorax nearly truncate at apex, anterior angles very obtuse 30

30. Sides of metasternum and met-episterna coarsely punctate. ..... **rubrica.**
Sides of metasternum and met-episterna smooth. ..... **musculus.**

It will be noted that two species belonging to the sixth division (*Lirus* Zimm.), are omitted from the table, namely *L. fulvipes* Putz. and *L. canadensis* Putz., no specimens being at hand for comparison. The descriptions are intercalated in the proper place.

A. avida *Say.*—Black or piceous, broad, oblong, thorax wide, narrowed posteriorly, hind angles nearly rectangular, base with numerous coarse punctures extending entirely across, basal foveæ ill defined though moderately deep. Elytral striæ deep, distinctly punctured. Antennæ and legs rufous. Length 8–9.5 mm., = .32–.38 in.

Habitat: NewYork, New Jersey, Massachusetts, Illinois, Indiana, Iowa.

A. arenaria *Lec.*—Much smaller that the preceding, piceous black, tip of abdomen reddish, legs, antennæ and palpi rufous or rufo-testaceous. Thorax with sides rounded, narrowed at base, median longitudinal line deep; the base is not punctured or only extremely finely so, and the basal foveæ are smooth. Elytra shining, striæ moderatety deep and scarcely visibly punctate. Length 6 mm. = .24 in.

Habitat: New York (Buffalo), Mt. Washington, New Hampshire.

A. similis *Kirby.*—Black or nearly so, shining, prothorax subquadrate, narrower at base, sides rounded, margin reflexed, of uniform

width, hind angles carinated, obtuse, basal impressions deep, punctured. Elytra rather finely striate, punctures small but distinct. Legs rather dark rufous, antennæ rufo-piceous, stout. Length 11–12 mm. = .44–.48 in.

Habitat: Canada, Northwest Territory, New Hampshire (Mt. Washington).

A. rufimanus *Kirby.*—Blackish, with very distinct greenish tinge, shining, form elongate. Thorax short, moderately narrowed posteriorly, sides rounded and with a sharp sinuation near the hind angles which are rectangular and prominent; basal impressions deep, punctured and with an acute carina on outer margin. Elytra very long, sides parallel, striæ well marked and distinctly punctured except toward the tip. Legs and antennæ rufous. Length 11.5–12 mm. = 46–.48 in.

Habitat: Canada, Wisconsin, Wyoming, Colorado, Magdalen Island.

The above description is made out from a pair named *lacustris* Lec., in my collection. The name is considered a synonym of *rufimanus* Kirby, though there is little of value in the last description.

A. laticollis *Lec.*—Broader and more oblong, piceous black, less shining, thorax larger in proportion to the elytra which are more rounded on the sides. Sides of thorax much rounded, sinuate near base, hind angles hardly as prominent as in *rufimanus*, basal foveæ deep, the carina well marked and acute. Elytral striæ with very distinct punctures except towards the tip. Antennæ, legs and epipleuræ rufous. Length 11–14 mm. = .44–.56 in.

Habitat: Kansas, Nebraska, Colorado, Wyoming, Illinois, Missouri, British America.

A. carinata *Lec.*—Differs from *laticollis* by the characters given in the table. These points are to be made out with tolerable ease from comparison though seemingly rather indefinite. Length 12–15 mm. = .48–.60 in.

Habitat: New Mexico, Colorado, Manitoba, Illinois.

A. elongata *Lec.*—Elongate, oblong-ovate, slender, rufo-piceous, thorax about equal in length and breadth, sides rounded, hind angles somewhat obtuse, basal foveæ bistriate, punctate, carina broad, not much elevated. Elytra broader than the thorax and with fine striæ which are finely punctate anteriorly. Length 10 mm. = .40 in.

Habitat: Lake Superior region.

A. hyperborea *Dej.*—Moderately elongate, blackish piceous,.

thorax narrower behind, sides rounded, oblique near the base and not sinuate. Hind angles obtuse, basal foveæ bistriate, basal region punctate, carina present but rather blunt. Elytra oblong ovate, striæ punctured, less distinctly so at apex. Legs reddish. Length 9–11 mm. = .36–.44 in.

Habitat: Labrador, White Mountains, New Hampshire.

A. brunnipennis *Dej.*—Oblong, head and thorax blackish-æneous, thorax with sides rounded, punctured behind, basal foveæ bistriate. Elytra brownish or obscure reddish, oblong, subparallel, striate-punctate, suture and margins blackish. Antennæ and base of tibiæ rufous, femora and tarsi rufo-piceous. Length 8.5 mm. = .34 in.

Habitat: Labrador, White Mountains, New Hampshire.

A. canadensis *Putz.*—Piceous, elytra submetallic, palpi testaceous, antennæ and legs brownish. Prothorax transverse, sides angulate, slightly rounded, hind angles rectangular, basal margin bisinuate, base punctulate, basal foveæ two, oblong, impressed. Elytra convex oblong-ovate, humeri somewhat rounded, striæ punctate. Episterna and sides of abdomen punctured. Length 11 mm. = .44 in.

Habitat: Northern Canada.

This species is unknown to me, the above description being translated from Putzeys. It probably will be easily recognized by the shape of the prothorax.

A. fulvipes *Putz.*—Black, shining, palpi, antennæ and legs rufous. Prothorax with the sides rounded, not sinuate, narrowed anteriorally and posteriorly. Anterior angles somewhat prominent, but rounded, hind angles acute, slightly prominent. Elytra oblong-ovate, narrowed behind, humeri obtusely angulate. Length 10 mm. = .40 in.

Habitat: Missouri (Putzeys), Allegheny, Pennsylvania (Hamilton.)

The description is translated from Putzeys. The Pennsylvania specimens sent as this species have the thoraxic margin somewhat sinuate near the base, which is coarsely punctured (to a varying degree of density) in the region of the foveæ, which are only moderately distinct. The female is broader and less shining than the male, and the sides of the thorax are more rounded.

A. apricaria *Payk.*—Oblong oval, piceous, surface feebly bronzed. Head smooth, frontal impressions moderate, antennæ pale rufous. Thorax one-half broader than long, sides moderately arcuate in front, slightly sinuous and feebly narrowed toward the base, hind angles rec-

tangular, slightly prominent. Basal foveæ deep, the inner one rounded, carina obtuse, one-fourth the length of the thorax; basal third of thorax punctured, punctures coarse, sparser in the middle. Elytra oval, moderately deeply striate (less so at apex), striæ crenate-punctate. Scutellar stria long, thoracic side pieces coarsely punctured, abdomen moderately coarsely punctured at sides. Length 8 mm. = .32 in. The description is taken from Dr. Horn's account of *Putzeysii*, which, he writes, is a synonym of the above.

Habitat: Newfoundland, Massachusetts, Europe.

A. septentrionalis *Lec.*—Elongate, oblong oval, blackish-piceous, more or less æneous above, thorax one-half broader than long, narrowed in front and behind, sides broadly rounded, base sparsely punctate, foveæ deep, double, hind angles sub-obtuse. Elytra striate, stria finely punctured, smooth at tip. Antennæ rufous, legs rufo-piceous. Prosternum with a broad feeble longitudinal channel, less evident in the female. Length 7.5 mm. = 30 in.

Habitat: Lake Superior, New York.

A. exarata *Dej.*—Convex, form sub-ovate, color blackish-piceous. Thorax sub-quadrate, somewhat narrowed behind, basal foveæ double, punctured. Elytra with deep-punctured striæ. Antennæ and legs rufous. Length 8–9 mm. = .32–.36 in.

Habitat: Northeast America in general.

A. latior *Kirby.*—Piceous, more or less bronzed. Prothorax broader than long, not sinuate at base, sides rounded, hind angles rectangular. Basal foveæ double, punctured, elytra striate, striæ punctured, less distinctly at apex. Length 9–10 mm. = .36–.40 in.

Habitat: New Hampshire, Canada, Lake Superior, Illinois, Wisconsin, Nebraska, Oregon, Idaho, Vancouver Island.

A. angustata *Say.*—Body oval, above black with cupreous reflections. Thorax broad, narrowed from the base, emarginate at apex, surface impunctate except in the neighborhood of the basal foveæ which may be sparsely punctate; hind angles acute. Elytra not wider than the thorax, narrowed from the base, striæ deeper behind, impunctured; legs rufous. Length 6.25–7 mm. = .25–.28 in.

Habitat: "Middle and Southern States." Ohio, New York, New Jersey, Wisconsin, Nebraska.

A. pallipes *Kirby.*—Elongate, oval, above cupreous or blackish-cupreous, thorax narrowed from about the middle to the apex, basal

foveæ double, slightly punctured; elytra broader that the thorax, striæ not deeper behind. Legs rufous. Length 7.5 mm. = .30 in.

Habitat: New York, Wisconsin, Canada, New Jersey, Iowa.

A. crassispina *Lec.*—Broadly oval, æneous above, body beneath and legs rufo-piceous, thorax twice as broad as long, narrowed anteriorly, sides obliquely rounded, sub-explanate behind, base hardly foveate, elytral striæ impunctate, not deeper behind. Antennæ piceous, the three basal joints testaceous. Length 9 mm. = .35 in.

Habitat: Lake Superior.

A. cupreolata *Putz.*—Oblong oval, above bronzed, thorax narrowing from a point in advance of the base. Legs piceo-rufous, hind angles of thorax slightly obtuse.

Habitat: New Jersey, Illinois.

A. fallax *Lec.*—Oval, æneous above, thorax nearly twice as broad as long, moderately narrowed anteriorly, sides rounded, anterior angles not prominent, basal foveæ indistinct, elytral striæ not deeper behind or only slightly so. Legs black, tibiæ piceous at base. Length 7.5–9 mm. = .30–.36 in.

Habitat: Lake Superior, New York, Alabama.

A. protensa *Putz.*—Oblong oval, scutellar stria without ocellate puncture. Thorax with very faint basal impressions, surface not punctured. Elytral striæ smooth.

Habitat: Illinois (Teste Bolter).

A. polita *Lec.*—Oval, shining, more or less cupreous, thorax twice as broad as long, narrowing anteriorly from before the middle, basal foveæ small but deep. Elytral striæ not deeper behind, legs black. Length 6.25 mm. = .25 in.

Habitat: Canada, New York, Nebraska, New Mexico, Idaho.

A. interstitialis *Dej.*—Oval, somewhat oblong, moderately convex, color variable from brownish bronze to bright green, cupreous or nearly black. Antennæ usually black, first joint sometimes pale. Thorax less than twice as wide at base as long, hind angles rectangular. Elytra with fine indistinctly punctured striæ, intervals slightly convex usually with undulating surface, the alternate ones often slightly more elevated, surface distinctly alutaceous. Body beneath smooth, and, with the legs, piceous black. Length 6.5–10 mm. = .26–40 in.

Habitat: Nova Scotia to Hudson's Bay, Alaska, Kamtschatka, south to Pennsylvania and northern California. Also found in Europe.

A. erratica *Sturm.*—Elongate oval, æneous, cupreous or nearly black, shining. Antennæ piceous black, two basal joints often red. Elytra differing as noted in table. Length 6–7.5 mm. = .24–.30 in.

Habitat: About as in the preceding, not coming farther south than Canada and Vermont.

A. obesa *Say.*—Oblong-oval, narrower in front, piceous-black, shining, the elytra opaque in the female. Antennæ ferruginous or brownish. Thorax about one-half broader than long, sides arcuate at apical half, then nearly parallel to base. Hind angles rectangular, disk moderately convex, basal foveæ two, the outer deeper and with an external carina. Basal region punctate, smoother at middle. Elytra striate, striæ finely punctured and more deeply impressed at apex, intervals slightly convex ♂, or flat ♀. Beneath piceous black, legs piceous or rufo-piceous. Length 9–12 mm. = .36–.48 in.

Habitat: New York, District of Columbia, Indiana, Montana, Michigan, Idaho, Hudson Bay, Colorado, Nebraska, Utah, Oregon, Washington.

A. remotestriata *Dej.*—Oblong-oval, moderately convex, brownish or very slightly piceous, males shining with faint bronze lustre, females dull. Antennæ always rufo-testaceous. Thorax about one-half broader at base than long, slightly wider at middle than at base, sides arcuate, hind angles sharply rectangular, basal foveæ double, shallow, basal region sparsely, often very feebly, punctate. Elytra finely striate, striæ smooth or very finely and feebly punctate, intervals flat in both sexes. Body beneath smooth, metathorax and abdomen darker, epipleuræ paler. Legs always pale rufo-testacous. Length 6.5–8 mm. = .26–.32 in. *A terrestris* Lec., is synonymous.

Habitat: New York, New Jersey, Minnesota, Wisconsin, Iowa, Montana, Idaho, Colorado, New Mexico, Canada, British Columbia, Washington, Oregon, Northern California.

A. chalcea *Dej.*—More broadly oval and more convex than *remotestriata*, piceous, shining in both sexes, surface slightly bronzed. Antennæ pale. Width of thorax at base not equal to twice the length, feebly narrowed anteriorly. Sides arcuate nearly from the base, hind angles rectangular, two foveæ on each side, both rather large and deep, and coarsely punctured. Elytra finely sharply striate, striæ not punctured, intervals flat. Beneath piceous black, legs rufo-testaceous. Length 6.5–7 mm. = .26–.28 in.

Habitat: Massachusetts, New York, District of Columbia, North

Carolina, Georgia, Texas, Michigan, Wisconsin, Nebraska, Colorado.

A. gibba *Lec.*—Oblong-oval, distinctly narrower in front, brownish or nearly piceous, shining, a feeble trace of bronze luster, legs always pale. Antennæ pale rufo-testaceous. Thorax one and three-fourth times as wide at base as long, slightly narrowed anteriorly, sides regularly arcuate, base slightly narrowed, hind angles rectangular. Entire basal region usually punctate. Elytra distinctly wider at base than the thorax, sides arcuate, disc moderately deeply striate, striæ finely but distinctly punctate, intervals flat, slightly convex near the base. Body beneath darker, shining. Length 6.5–7.5 mm. = .26–.30 in.

Habitat: Lake Superior region, Colorado, Arizona, South California, New Jersey.

A. harpalina *Lec.*—Form oblong, rufo-piceous or testaceous, moderately shining. Legs and antennæ rufo-testaceous. Thorax at middle less than twice as wide as long, slightly narrowed in front, sides arcuate in front, oblique at basal half, hind angles sharply rectangular, basal region vaguely bi-impressed each side, this whole region punctate. Elytral base wider than that of thorax, disk moderately deeply striate, striæ finely crenately punctured, intervals convex. Beneath usually paler than above, sides of metasternum and episterna very coarsely and closely punctate, the sides of first three ventral segments more sparsely so. Length 6.25–7 mm. = .25–.28 in.

Habitat: Utah and New Mexico. Reported from New Jersey under the synonym *acutangula* Putz.

A. subænea *Lec.*—Form oblong-oval, narrowed anteriorly, piceous, faintly bronzed, shining. Antennæ rufo-testaceous. Thorax about one half wider at base than long at middle, distinctly narrowed at apex, sides regularly arcuate, front angles prominent, hind angles rectangular. Elytra not wider at base than the thorax, striæ moderately deep, finely crenately punctured, intervals convex. Beneath usually paler than above, sides of metasternum and first two ventral segments with a few coarse punctures. Length 5–7 mm. = .20–.28 in.

Habitat: Lake Superior Region, Nebraska, Colorado.

A. rubrica *Hald.*—Oblong, moderately convex, rufo-testaceous to castaneous, shining in both sexes. Antennæ pale. Thorax not twice as wide as long, very little narrowed in front, apex very feebly emarginate, sides regularly arcuate, hind angles usually very obtuse, disc convex, basal impressions very feeble, usually punctured, sometimes quite

smooth. Elytra at base very slightly wider than the thorax, striæ moderately deep, finely crenately punctured, intervals convex. Beneath paler, sides of metasternum and the met-epimera with coarse punctures. Ventral segments coarsely sparsely punctate at sides of the first four. Legs pale rufo-testaceous. Length 6–7 mm. = .24–.28 in.

Habitat: Middle States region to Texas and Colorado.

A. musculus *Say.*—Oblong oval, rufo-piceous or piceous, shining, sometimes faintly æneous. Antennæ pale. Thorax rather more than half wider than long, distinctly narrowed anteriorly, sides arcuate, hind angles usually obtuse, sometimes nearly rectangular, basal impressions almost obliterated, surface near hind angles sparsely indistinctly punctured or entirely smooth. Elytra at base not wider than the thorax, striæ moderately deep, finely crenately punctured, intervals slightly convex. Beneath of nearly same color as above, abdomen usually paler, first ventral segment with a few punctures at sides. Legs rufo-testaceous. Length 5–5.5 mm. = .20–.22 in.

Habitat: Pennsylvania, Ohio, Illinois, District of Columbia, North Carolina, Wisconsin, Nebraska, Arizona.

Loxandrus *Lec.*

Differs from *Pterostichus* and allied genera by the anterior tarsi being obliquely dilated in the males. The species included are usually black, shining, iridescent beetles, rarely with any color-markings beyond the tendency to piceous or yellow shades of the appendages. They occur chiefly in the Southern States, and are difficult of separation besides being quite rare in collections. A tabular arrangement of the characters regarded as of specific value by previous writers will allow us to separate them as follows: the species from the region under consideration all belonging to Dr. LeConte's division in which the side margin of the prothorax is not explanate posteriorly, and the hind angles rounded or rarely rectangular.

Synopsis of Species.

Elytra with a post-median ferruginous spot. .... **celer.**
Elytra immaculate.
  Smaller (.20–.18 in.). Color of legs variable, hind angles of prothorax with the tip rounded..... .... **agilis.**
  Larger (.38–.40 in.).
    Hind angles of prothorax rounded at tip..... **minor.**
    Hind angles of prothorax rectangular..... **erraticus.**

L. celer *Dej.*—Black, moderately brilliant, antennæ and legs

blackish-brown, the first joint of the former ferruginous. Elytra with a common reddish sutural spot near the tip; striæ extremely finely punctured, intervals flattened, the third with one large puncture, slightly in advance of the middle, near the second stria. Prothorax subquadrate. Length 6–7 mm. = .24.28 in.

Habitat: Illinois, Florida, Texas.

L. agilis *Dej.*—Black, shining, iridescent, prothorax subquadrate, narrower anteriorly, the base punctured at middle, hind angles rounded at tip. Legs piceous or ferruginous, antennæ ferruginous at base becoming darker toward the tip. Elytra with strongly punctured striæ. Length 5–6 mm. = .20–.24 in.

Habitat: District of Columbia, Arkansas, Pennsylvania, south to Florida.

L. minor *Chaud.*—Black, shining, thorax moderately rounded at sides, base nearly smooth, the hind angles obtuse with the extreme tip rounded. Elytral striæ finely punctured, interstices moderately convex. Antennæ dark, except the three basal joints which are reddish. Legs reddish or with femora piceous. Length 9–10 mm. = .36–.40 in.

Habitat: Louisiana, District of Columbia, Arkansas, Indiana, Illinois, Missouri.

L. erraticus *Dej.*—Black, shining, iridescent, prothorax subquadrate, the hind angles not rounded. Elytra striate, striæ with obsolete punctures. Legs reddish or brownish, femora ordinarily darker. Antennæ dark, first two joints reddish. Length 9.5 mm. = .38 in.

Habitat: Illinois, Florida, Louisiana.

Diplochila *Brullé.*

Flattened insects of rather broad form and smooth surface. The elytra have the eighth and ninth striæ very close together, the third interspace has a large puncture near the middle; the elytral margin is not interrupted at posterior third as in the Pterostichini. Supra-orbital setigerous punctures, two. The species are few in number and may be distinguished by these characters:

Synopsis of Species.

Thorax with hind angles moderately well defined.
  Seventh stria of elytra feeble, not approaching the sixth in distinctness.
    Smaller (13–15 mm.) ..... **laticollis.**
    Larger (18–20 mm.) ..... var. **major.**
  Seventh stria of the elytra about as distinct as the sixth. Thorax less narrowed in front, more so at base..... **impressicollis.**
Thorax with hind angles obtusely rounded. Smaller, elytral striæ finer, seventh almost obliterated..... **obtusa.**

D. laticollis *Lec.*—Black, somewhat shining, thorax transverse, sides slightly rounded and feebly sinuate towards the base, hind angles distinct. Elytra moderately deeply rather finely striate, the striæ with fine punctures, seventh feeble. Length 13–20 mm. = .52–.80 in.

Habitat: New York, New Jersey, Pennsylvania, Indiana, Illinois, Iowa, Canada, Nebraska, Kansas, Michigan, Florida.

D. impressicollis *Def.*—Usually black, sometimes the alternate elytral interstices are reddish. The thorax differs from that of *laticollis* as stated in the table; and the seventh elytral stria, while sometimes slightly fainter than the sixth, is still distinct. Length 16–17 mm. = .64–.68 in.

Habitat: New York, Canada, Michigan, Indiana, Iowa, Illinois, South Dakota, Utah, Washington, Oregon.

D. obtusa *Lec.*—Black, smaller than the other species and with the outer striæ of the elytra very weak, the sixth being often quite feeble, while the seventh may be almost obliterated. The thorax has rounded hind angles and very deep well-defined basal foveæ. Length 11–12 mm. = .44–.48 in.

Habitat: Illinois, Indiana, Iowa, Kansas, Nebraska, Nevada.

Dicælus *Bon.*

Usually large species of black, purplish or metallic color, the thorax broad, the elytra usually deeply striate, the seventh interval carinate from the humerus to a varying distance. With the exception of *lævipennis*, which extends into western Arizona, they are confined to the region east of the Rocky Mountains and to Mexico, being more numerous in the Atlantic States, especially those to the south.

Synopsis of Species.

Elytral intervals very irregular, broken up by deep rugosities or by ocellate punctures ..... **sculptilis.**
Elytral intervals regular, or at least entire.
Thorax broad at base, narrowed at apex.
Elytra brilliant, brassy or cupreous ..... **splendidus.**
Elytra violaceous or purplish ..... **purpuratus.**
Elytra black.
Elytral intervals feebly alternating, humeral carina moderately long. **furvus.**
Elytral intervals equal.
Striæ very distinctly punctured ..... **crenatus.**
Striæ not or very finely punctured.
Smaller species (15–18 mm.).
Form shorter, thorax with one segiterous puncture near middle of

margin .... **ovalis.**
Form elongate, thorax with two setigerous punctures near middle of margin .... **elongatus.**
Larger species (20–25 mm.).
Form elongate, sides of thorax reflexed posteriorly ...... **ambiguus.**
Form broad, sides of thorax not or but slightly reflexed posteriorly, elytral intervals rather narrow, convex.............. **dilatatus.**
Thorax narrowed at base, elytra feebly shining .... **teter.**
Thorax about equally narrowed at base and apex, humeral carina short, elytra very shining.................. .... **politus.**

Most of the above characters have already been used in the synoptic table of *Dicælus* published some time ago by Dr. Horn in the Brooklyn Bulletin. The arrangement has been changed to suit the different conditions consequent upon the more restricted fauna under consideration. The setigerous punctures referred to under *ovalis* and *elongatus* are actually anterior to the middle, but the above wording has been adopted to keep students from misconstruing the punctures meant. There is usually a sub-basal puncture to be seen and often a sub-apical bristle as well.

D. sculptilis *Say.*—Black, shining, but without metallic luster. Easily known from the other species of the genus by the peculiar roughness of the elytra, the alternate intervals being curiously broken and distorted. The bottoms of the striæ are granulate or marked with ocellate punctures. Length 16–20 mm. = .64–.80 in.

Habitat: Ohio, Pennsylvania, Wisconsin, Iowa, Illinois, South Dakota, Kansas, District of Columbia, Maryland, Manitoba.

D. splendidus *Say.*—Blackish with violaceous or purplish reflections, especially on margins of pronotum and on lower surface of body. Upper surface of prothorax marked with fine wavy lines, mostly trans. verse in direction, median longitudinal line very clear and sharp-cut. Elytra coppery or brassy, shining, striæ deep, intervals convex. Length 18–25 mm. = .76–1.00 in.

Habitat: Nebraska, Kansas, Iowa, Illinois, Missouri, Louisiana.

D. purpuratus *Say.*—Very closely resembling *splendidus*, but differing in being of a purplish or violaceous color, without brassy elytra, the antennæ and legs black. The form is more elongate than in *splendidus*, and the head larger in proportion. Length 20–25 mm. = .80–1.00 in.

Habitat: New York, Massachusetts, Pennsylvania, Indiana, Louisiana, Florida, Missouri, Illinois, Iowa.

D. furvus *Dej.*—Form short, broad, color blackish-opaque, or slightly shining. The median thoracic line is feeble, the lateral margins slightly reflexed. Elytral intervals alternating, striæ smooth. The interval between the sixth and seventh stria bears several punctures near the base. Length 15 mm. = .60 in.

Habitat: Ohio, Kentucky, Missouri, Florida.

D. crenatus *Lec.*—The district punctuation of the elytral striæ will serve to separate this species from its neighbors. I have seen no specimens and am unable to give other differential characters. Length 15–16 mm. = .60–.64 in.

Habitat: Louisiana, Texas; recorded also from Buffalo, New York.

D. ovalis *Lec.*—Black, form short, the median thoracic line very distinct and deeper near base and apex. Elytral striæ deep, smooth, intervals not alternating, humeral carina long. Length 15–16 mm. = .60–.64 in.

Habitat: New York, New Jersey, Pennsylvania, Illinois, Maryland, District of Columbia, Ohio, Texas.

D. elongatus *Bon.*—Form more elongate than in the preceding species, thorax with deep and distinct longitudinal median line, two deep setigerous punctures anterior to the middle of the prothorax. Elytra with deep regular striæ, intervals convex, not alternating. Length 15–18 mm. = .60–.76 in.

Habitat: New York, New Jersey, Pennsylvania, Illinois, Indiana, Ohio, Maryland, District of Columbia, Texas, Iowa, Louisiana, Mississippi.

D. ambiguus *Laf.*—A large species of black color, either opaque or more or less shining. The sides of the thorax are reflexed behind, the form elongate. Length 20–22 mm. = .80–.87 in.

Habitat: New York, Pennsylvania, Illinois, Missouri, District of Columbia, Alabama, Mississippi.

D. dilatatus *Say.*—Black, dull, or with a slight surface luster. Form broad, short, sides of thorax hardly reflexed posteriorly; elytra with broad deep striæ which are almost smooth except for traces of punctures near the tip. Length 20–25 mm. = .80–1.00 in.

Habitat: New York, New Jersey, Pennsylvania, Ohio, Maryland, Indiana, Illinois, Missouri, District of Columbia, Virginia, Alabama, Texas.

D. teter *Bon.*—Black, slightly shining, thorax broader in front of middle and considerably narrowed behind, longitudinal median line very deep. Elytra deeply striate, striæ smooth, intervals regular, very convex. The form of thorax gives somewhat the appearance of certain Pterostichi. Length 20–22 mm. = .80–.88 in.

Habitat: New York, Pennsylvania, Ohio, Maryland, New Jersey, District of Columbia, Virginia.

D. politus *Dej.*—Smaller, black, very shining, form resembling that of *teter*, but the thorax is more nearly quadrate, being less narrowed behind. The elytra are regularly, smoothly and deeply striate, the humeral carina short and obtuse. Length 12–15 mm. = .48–.60 in.

Habitat: New York, New Jersey, Pennsylvania, District of Columbia, Florida.

Licinus *Latr.*

Antennæ with thre ebasal joints glabrous, eighth and ninth striæ of elytra distinct; elytra strongly sinuate at apex, seventh interval not carinate.

L. silphoides *Fabr.*—Black, somewhat shining, thorax rounded, punctate. Elytra with three rather faint costæ, punctato-striate, interspaces deeply and closely punctured. Length 14–15 mm. = .56–.60 in.

Habitat: Massachusetts. Not a true member of our fauna, being a European species.

Badister *Clairv.*

Small beetles of a form suggesting our common species of *Agonoderus*. They differ from the three preceeding genera in having only two basal joints of the antennæ entirely glabrous. The eighth and ninth elytral striæ are not approximated, the third interval has two dorsal punctures. A condensation of Dr. Leconte's table will suffice to separate the species of northeastern America as follows:

Synopsis of Species.

Elytral striæ deep, interspaces narrow, convex. Elytra rufo-piceous, darker behind, antennæ and legs reddish..... ..... **notatus.**

Elytral striæ fine, interspaces flat.

Elytra spotted.

Prothorax, legs and elytra bright yellow, the latter with broad median band interrupted at suture and an apical blotch iridescent black.....**pulchellus.**

Prothorax black, legs and elytra orange, the latter with broad median band and apical spot black, confluent longitudinally from 4th to 6th stria. **maculatus.**

Elytra not spotted, sometimes bicolored.

Prothorax and legs testaceous, elytra piceous, margined at base, sides and suture with testaceous, epipleuræ testaceous. Hind angles of prothorax broadly rounded ..... **obtusus.**

Piceous, head as broad as the prothorax, hind angles of latter obtuse and slightly rounded ..... **ferrugineus.**

Black or nearly so, legs yellow.

Hind angles of prothorax very much rounded..... ....**flavipes.**

Hind angles of prothorax not or feebly rounded, margin piceous.

Side margin of prothorax narrow, not more reflexed towards base. **micans.**

Side margin broader, more reflexed near base ... . **reflexus.**

B. notatus *Hald.*—The characters given above will amply distinguish this species, as it is the only one in our fauna with deep elytral striæ and narrow convex interspaces. Length 4.5 mm. = .18 in.

Habitat: Canada, New York, New Jersey, Illinois, Louisiana, Iowa.

B. pulchellus *Lec.*—Above bright yellow, head black, elytra with a very large submedian spot on each, reaching nearly to the suture and each with an apical spot, black. The two spots on each elytron may be connected by a broad longitudinal stripe or may be quite separate. Beneath mostly black, the legs and prothorax yellow. Antennæ dusky, first joint yellow. Length 5.5–6.5 mm. = .22–.26 in.

Habitat: New York, Indiana, Illinois, Iowa, Wisconsin, Canada, Georgia, Florida.

B. maculatus *Lec.*—Black, thorax with deep transverse impression, elytra orange-yellow with black markings as given in the table. Legs yellow, antennæ dusky, first joint testaceous. Length 6 mm. = .24 in.

Habitat: Pennsylvania.

B. obtusus *Lec.*—Piceous, shining; prothorax, base of antennæ and legs testaceous. Elytra obscure reddish, side margins paler. Hind angles of prothorax rounded, basal impressions round, deep and fovei form, transverse lines quite feeble, longitudinal median line deep. Length 5.8–6.5 mm. = .23–.26 in.

Habitat: Lake Superior, Montana (Helena).

B. ferrugineus *Dej.*—Above, head black, thorax reddish or rufo-piceous; elytra piceous with bluish or greenish iridescence, margin narrowly testaceous. Beneath, blackish except the prothorax which is reddish, legs testaceous. Antennæ blackish, first joint yellow-testaceous. Other characters will be found in the table. Length 4.5–5 mm. = .18–.20 in.

Habitat: California and Alaska—said to be found at Buffalo, N. Y.

B. flavipes *Lec.*—Black, thorax somewhat narrowed behind, hind angles very much rounded, longitudinal line deep, basal impressions small but deep. Elytra more deeply striate than usual in this group, the interstices more convex; in color they are blackish with a bluish-metallic luster; legs yellowish testaceous, antennæ fuscous. Length 6 mm. = .24 in.

Habitat: New York, Pennsylvania, Louisiana, Florida.

B. micans *Lec.*—Differs from the preceding in the form of the hind angles of the prothorax (as stated in the table) and in the fact that the luster of the elytra is simply blue, not metallic. The striæ of the elytra are less deep and the interstices less convex. Length 5–6 mm.

Habitat: Massachusetts, New York, New Jersey, Illinois, Georgia, Florida.

B. reflexus *Lec.*—Smaller than *micans*, piceous, shining, margin of prothorax and elytra testaceous, the latter with faint metallic reflections. Prothorax trapezoidal, narrowed behind and with the sides more strongly margined than usual, the margin broader and more strongly reflexed near the base; hind angles very obtuse. Legs yellowish, antennæ piceous, tip of last joint pale. Length 4 mm. = .16 in.

Habitat: New York, Michigan, Lousiana, Pennsylvania.

(*To be continued.*)

ILLUSTRATIONS OF NORTH AMERICAN TETTIGIN.E.

By A. P. Morse, Wellesley, Mass.

(See articles in this Journal, March and September, 1895.)

Explanation of Plate.

Figs. 1, 1*a*, 1b. *Nomotettix parvus* ♂.
" 2, 2*a*, 2b. " *cristatus* ♂.
" 3, 3*a*, 3b. " *compressus* ♂.
" 4, ♀; 4*a*, ♂. *Tettigidea prorsa*.
" 5, ♀; 5*a*, ♂. " *parvipennis*.
" 6, ♀; 6*a*, ♂. " *lateralis* (?), from Indiana.
" 7, ♀. " *acuta*.
" 8, ♀; 8*a*, ♂. " *apiculata*.
" 9, ♀; 9*a*, ♂. " *spicata*.
" 10, ♀; 10*a*, ♂. " *armata*.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

Meeting of June 18th, 1895.

Held at the American Museum of Natural History. President Rev. J. L. Zabriskie in the chair. Twelve members present.

Mr. Beutenmuller proposed for active membership Dr. G. Langmann and Mr. David H. Ray, and for corresponding membership Mr. F. H. Johnson.

An invitation to join the Philadelphia, Newark and Brooklyn Entomological Societies in a field meeting at Jamesburg, New Jersey, on July 4th, was received and accepted with thanks.

Mr. Beutenmuller read a paper "On Collecting at Watchogue Staten Island," communicated by Mr. Wm. T. Davis.

Mr. Johnson exhibited a piece of stone which he found over an ant nest and which had been bored through by the ants, who used the hole as one of the entrances to their nest.

Mr. Fayen exhibited a gooseberry leaf, with the stalk partly eaten through by *Gymnetron teter*, a weevil, living in the seed pods of the Mullein.

"A Copy of Comstock's Manual to the Study of Insects," was exhibited and recommended to the members of the society.

Mr. Zabriskie spoke on species of *Coleophora* living on Juncus, which he said appeared in salt meadows near the sea shore of Long Island. Adjournment.

Meeting of September 17th, 1895.

Held at the American Museum of Natural History. In absence of the President Mr. Ottomar Dietz was elected chairman *pro tem.* Nine members present. The treasurer's report was read and accepted.

Dr. Langmann and David H. Ray were elected members of the society and Mr. F. H. Johnson as a corresponding member.

Notes on the summer's collecting were given by the members. Mr. Dyar showed the larva of a *Harrisina* from Texas which had two of the segments entirely black, thus differing from the eastern species which has all the segments with yellow bands. He also exhibited the larva and moth of *Alypia langtoni* from the White Mountains, N. H.—Adjournment.

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NEW SPECIES OF HETEROCERA.

By William Schaus.

Perophora funebris, sp. nov.

♂. Wings and abdomen dull brownish black with the basal and outer lines almost imperceptible, the latter starting from the costal margin at two-thirds from the base, convexly oblique to vein 7 and then straight to the middle of inner margin. Underneath, this line is wavy and closer to the outer margin. The ♀ is dark brown with the markings as in the ♂ and an oval spot in the cell. Expanse ♂ 45 mm. ♀ 62 mm.

Habitat: Castro, Parana.

Perophora nigrescens, sp. nov.

Wings pale gray, shaded with brown on the extreme outer margins and finely speckled with black, especially on the median space of the primaries. The primaries with a broad black shade at a third from the base and an outer black band angled at vein 7; at the end of the cell a small diaphanous spot. The secondaries with a median black line. Underneath darker, with only an outer line which is curved on both wings. Body light gray speckled with black. Expanse 42 mm.

Habitat: Castro, Parana.

Perophora musa, sp. nov.

Body dark gray, the abdomen dorsally shaded with red. Wings above gray, finely and thinly speckled with black; an indistinct median darker shade minutely speckled with red; at the end of the cell a transparent spot; the costal margin narrowly red; the outer line, fine, dark brown, starting obliquely from the costal margin at four-fifths from the base, forming an angle between veins 7 and 8, and then slightly wavy to the middle of the inner margin of the secondaries. Beyond the line the wings are slightly darker and shaded with red on the inner margins and at the angle on the primaries. Underneath the primaries are darker and the veins on both wings are shaded with red. Expanse ♂ 43 mm. ♀ 51 mm.

Habitat: Castro, Parana.

This species is allied to *P. despecta* Walk.

Perophora pulverula, sp. nov.

Wings above gray finely and thinly speckled with black, a wavy basal brown line, and an outer very dentate brown line; at the end of the cell two contiguous diaphanous spots circled by a fine brown line; fringe brown. Underneath paler with no basal line, and the outer line is closer to the margin and more lunular than dentate. Expanse ♀ 50 mm.

Habitat: São Paulo, S. E. Brazil.

Perophora grisea, sp. nov.

Body and wings above pale brownish gray, thinly speckled with black; a minute transparent spot at the end of the cell on the primaries; the outer line lunular, fine, dark gray, followed by a brownish shade which widens towards the anal angle of the secondaries and is outwardly margined with a blackish line forming long projections between the veins. Underneath pale brownish gray with an outer and a submarginal dentate blackish line. Expanse ♂ 45 mm.

Habitat: São Paulo, S. E. Brazil.

Perophora deprava, sp. nov.

Primaries acute, the outer margin convex opposite vein 3. Wings above light gray minutely speckled with black; an indistinct gray transverse line at a third from the base on the primaries; a black spot at the end of the cell; the outer line dark, forming a black spot on the costal margin, then concave to vein 7 where it is rounded, and then wavy to the inner margin; the fringe brownish gray. Underneath the wings are darker with the outer line finely dentate. Expanse ♂ 35 mm.

Habitat: São Paulo, S. E. Brazil.

Perophora olivia, sp. nov.

Thorax pinkish brown. Abdomen olive brown with darker scales on the anal segment. The basal three-fourths of the wings olive brown, with a large round yellow spot in the cell on the primaries. Two nearly contiguous straight black lines, separated by a fine pinkish brown shade from the anal angle on the secondaries, to vein 8 on the primaries, where the inner line forms an indistinct angle to the costal margin, and the outer line follows vein 8 to the outer margin, above which the costal margin and apex are dark brownish. The outer margins broadly pink shaded with olivaceous on the extreme margin. Underneath the same but paler. Expanse 42 mm.

Habitat: Columbia.

Colabata dora, sp. nov.

Thorax grayish; abdomen yellowish brown irrorated with darker scales. Primaries grayish thickly mottled with darker scales; the outer margin broadly yellowish, a very indistinct wavy basal line, a small yellowish spot containing a brown point in the cell; an irregular outer wavy shade separating the darker portion of the wing from the yellowish outer margin; a terminal lunular brown line; the base and extremity of the fringe brownish. Secondaries light brown, somewhat yellowish on the outer margin; a fine median transverse line and a broad submarginal brown shade. Underneath cream color with two median transverse brown lines and a terminal lunular line on the primaries. Expanse 50 mm.

Habitat: São Paulo, S. E. Brazil.

Closely allied to *C. marginalis* Walk. (*lineosa* Wlk.), but darker and with the markings less distinct.

Apatelodes velutina, sp. nov.

Head and patagiæ violaceous gray, center of thorax very dark brown; abdomen brown with grayish scales on the posterior portion of each segment. Primaries with the basal portion light brown limited by a dark line, heaviest on the costal margin, slightly oblique to below vein 2, and then turning in to the inner margin, preceded on the inner margin near the base by a dark brown shade; the median space velvety gray limited by a dark wavy outer line and containing an indistinct pale streak at the end of the cell; the outer margin gray mottled with reddish brown; a dark velvety brown spot on the costal margin near the apex, followed by two small transparent white spots. Secondaries reddish brown, much darker at the anal angle, above which is the commencement of a transverse line. Underneath the wings are dull reddish brown with a transverse whitish line crossing both wings. Expanse ♀ 38 mm.

Habitat: São Paulo, S. E. Brazil.

Apatelodes corema, sp. nov.

Body light brown with some gray scales on the patagiæ. Primaries light creamy brown; some grayish scales along the costal margin; a basal, indistinct, wavy gray line, followed on the inner margin by a large patch of gray scales; the outer transverse line deeply wavy, outwardly shaded with pale scales and followed by two transparent spots between veins 4 and 5 and 5 and 6. Secondaries light reddish brown. Underneath light reddish brown; an indistinct median transverse shade and an outer line, fine and straight on the primaries, but forming a series of black points on each vein on the secondaries. Expanse ♀ 43 mm.

Habitat: São Paulo, S. E. Brazil.

Apatelodes sericea, sp. nov.

Head dark brown. Thorax pale fawn color, the posterior portion dark velvety brown preceded by a fine transverse line. Abdomen brown, very dark dorsally at the base. Primaries above pale fawn color; a fine oblique line near the base from the costa to the submedian vein, below which is a broad dark shade resting on the inner margin and outwardly bordered by a fine grayish line; a wavy, narrow median transverse shade; the outer line very fine and wavy with a dark point on each vein; some brownish submarginal shades near the apex and a small transparent spot. Secondaries brown, very dark on the inner margin; an indistinct transverse pale line. Underneath fawn color shaded with brown at the apex of the primaries; on the secondaries a median brown spot and an outer grayish line; some submarginal brown shades. Expanse ♂ 45 mm. ♀ 65 mm.

Habitat: São Paulo, S. E. Brazil.

Thelosia, gen. nov.

Antennæ pectinated in the ♂, pubescent in the ♀. Legs slightly hairy. Primaries with the costal margin slightly sinuate, acute at the apex, and the outer mar-

gin very convex at vein 5. Veins 6–10-stalked. Secondaries rounded in the ♂, somewhat oblong in the ♀; the costal margin nearly straight; neuration as in *Colabata* Walk. = *Dorisia* Mösch.

Thelosia phalæna, sp. nov.

♂. dark reddish brown above without markings. Underneath duller brown with the costal margins of the primaries and secondaries entirely and thickly speckled with chrome yellow scales; a black point in the cells and an outer transverse brown line.

♀. Thorax violaceous gray. Abdomen reddish brown. Primaries above olive brown with two darker transverse lines, the inner one faintly curved, the outer one straight and parallel with the outer margin; the base of the wings and the outer portion of the transverse lines heavily shaded with lilacine scales; a cluster of similar scales in the cell. Secondaries light reddish brown with an indistinct spot in the cell and an outer transverse darker line. Underneath yellowish brown; a dark transverse streak in the cell and an outer brown line; some lilacine scales at the apex of the primaries. Expanse ♂ 30 mm. ♂ 45 mm.

Habitat: Nova Friburgo, Brazil.

Thelosia camina, sp. nov.

♀. Thorax gray. Abdomen light brown. Primaries fawn color finely speckled with brown; an inner transverse brown line, and an outer similar line, slightly curved from the costa to vein 2, and then straight to the inner margin. Secondaries brownish at the base, fawn color on the outer portion; an indistinct dark median line. Underneath grayish brown with an indistinct transverse line and minute spot in the cell. Expanse 38 mm.

Habitat: Castro, Parana.

Closely allied to *T. phalæna* Schs. but with the outer line always different; in one specimen the median space is heavily shaded with dark brown.

Thelosia truvena, sp. nov.

♂. Body light brown; patagiæ and a transverse posterior line on each segment of the abdomen light gray. Primaries above brownish gray, finely speckled with darker scales; a straight brown basal line followed by a brownish shade; a minute brown spot in the cell, followed by a straight brown line; an outer and a subterminal very fine and indistinct brown line, between which the dark scales form an indistinct band. Secondaries light fawn color with two very indistinct transverse brownish lines. Underneath pale fawn color with a median transverse line, a minute brown spot in the cell and an outer wavy brown line on the secondaries. Expanse 30 mm.

Habitat: São Paulo, S. E. Brazil.

Thelosia tropea, sp. nov.

Thorax gray with a dorsal dark streak. Abdomen brownish shaded with gray posteriorly on the segments. Primaries gray; a broad basal transverse angular brown band, and an outer band nearly straight on the inner side, but outwardly angular and followed by a very fine angular subterminal line; in the cell a pale gray streak.

Secondaries light brown. Underneath primaries gray shaded with brown along the costa, and an indistinct subterminal line; secondaries brownish with a median darker line. Expanse 28 mm.

Habitat: Castro, Parana.

Tarema, gen. nov.

Antennæ pectinated as in *Perophora*. Primaries with the costal and outer margin slightly convex, the inner margin straight; veins 4, 5, 6 starting from disco-cellular; 7 and 8 stalked from upper angle of cell; a wide space between 8 and 9; Secondaries with the apex very rounded; veins 3 and 4 from lower angle of cell; 5 from middle; 6 and 7 on short stalk from upper angle.

Tarema rivara, sp. nov.

♂. Abdomen reddish brown. Primaries gray along the costa, reddish on the inner margin above the inner angle and at the apex; a whitish transverse outer line at two-thirds from the base, followed from the costa to the middle of the outer margin by a similar line; an oblique dark spot circled with whitish in the cell. Secondaries reddish; a black spot in the cell and a black transverse median line; the costa shaded with gray. Underneath mottled gray and dull red with a double, wavy, submarginal whitish line and the discal spots rather more conspicuous. Expanse 27 mm.

Habitat: São Paulo, S. E. Brazil.

What I believe to be the ♀ of this species has the reddish shades replaced by dark brown.

Sibine extensa, sp. nov.

Head and thorax dark glossy brown nearly black. Abdomen light reddish brown. Primaries reddish brown darkest in the cell; four-fifths of the costa, the median nervure broadly, and the fringe with a silky hue; a single minute white spot beyond the cell. Secondaries light reddish brown with the fringe very dark at the anal angle. Underneath reddish brown. Expanse ♂ 38–46 mm. ♀ 54–64 mm.

Habitat: Jalapa, Mexico.

I have retained for this species a MSS. name given by the late Hy. Edwards.

Sibine plora, sp. nov.

♂. Body dark silky brown, the center of the thorax reddish. Primaries dark silky brown; a streak below the median vein, one through the cell to the apex, and the outer margin dull reddish brown. Secondaries reddish brown, very dark on the inner margin, the veins somewhat paler. The ♀ has a violaceous hue over the silky brown portion of the primaries, and the secondaries are light brown, with dark fringe. Expanse ♂ 34 mm. ♀ 45 mm.

Habitat: Aroa, Venezuela.

This species is allied to *S. modesta* Cr., of which I have a good series from the same locality.

Sibine auromacula, sp. nov.

♂. Body dark silky brown. Primaries silky brown; a large round and a small golden spot below the median vein, and three similar spots beyond the cell, the middle one much the largest and s-shaped. Secondaries with the costal and inner margins broadly dark brown, the rest of the wing white, transparent. Underneath dull brown, except the transparent portion of the secondaries. The ♀ entirely light reddish brown with the golden spots rather larger than in the ♂. Expanse ♂ 31 mm. ♀ 50 mm.

Habitat: Aroa, Venezuela; Pernambuco, Brazil.

Aidos castrensis, sp. nov.

Head and thorax gray. Abdomen brownish. Primaries light gray, the inner margin brownish; two dark indistinct spots near the base; an outer interrupted blackish line, dentate on veins 3, 4 and 5; a terminal row of blackish points; a short upright white line on the inner margin near the angle. Secondaries white faintly tinged with pink on the inner margin; a terminal row of brown spots. Expanse 25 mm.

Habitat: Castro, Parana.

Perola platona, sp. nov.

Dark reddish brown; primaries with some still darker indistinct basal streaks extending to the end of the cell; an indistinct dark shade from the apex to the middle of the inner margin. Expanse 35 mm.

Habitat: Aroa, Venezuela.

Veins 2 and 3 on the primaries, also 7, 8 and 9 are stalked as in *Perola murina*, Walk. The following species should be placed in the genus *Perola: Trabala drucei* Schs., *T. brumalis* Schs., *T. circur* Schs., *T. rubens* Schs., *T. druceoides* Dogn., *Asbolia sericea* Mösch.

Perola sucia, sp. nov.

Body brownish yellow, the patagiæ violaceous gray. Primaries fawn color thickly mottled with grayish scales; a median transverse darker shade consisting of blotches of gray scales; an outer irregular row of small dark gray spots, and a few similar spots below the apex on the outer margin; the extreme margin finely brown. Secondaries brownish yellow. Underneath brownish yellow without markings. Expanse 30 mm.

Habitat: Rio Janeiro and São Paulo, Brazil.

Closely allied to *Perola subpunctata* Walk.

Prolimacodes, gen. nov.

Differs from *Eulimacodes* in having vein 10 arise from the cell.

Prolimacodes triangulifera, sp. nov.

Body brown. Wings the same shade with a fine white line extending a short distance along the costa from the base, descending from the middle of vein 1 *b* and

then faintly sinuate to the apex; the portion enclosed by this line is heavily shaded with darker brown. Expanse 30 mm.

Habitat: Jalapa, Mexico.

This species strongly resembles *E. scapha* Harris.

Dalcera obscura, sp. nov.

Dark golden brown, the costal margin of the secondaries somewhat paler. Expanse 21 mm.

Habitat: São Paulo, S. E. Brazil.

Dalcera citrina, sp. nov.

Entirely pale lemon color. Expanse 17 mm.

Habitat: Trinidad, B. W. I.

Eupoeya jamaicensis, sp. nov.

Primaries above silvery white. Secondaries light gray, darker along the outer margin. Underneath primaries grayish with the veins white, and a terminal dark gray line. Secondaries below white with the outer margin dark gray. Expanse 17 mm.

Habitat: Jamaica, B. W. I.

The neuration of this species agrees with *Eupoeya nivalis* Pack.

Cyclara, gen. nov.

Wings short and rounded. Primaries—vein 3 from lower angle of cell; 4 and 5 from angle in discocellular; 7, 8, 9 from very long stalk at upper angle of cell 10 also from upper angle of cell. Secondaries with veins 3 and 4 from lower angle of cell; 5 and 6 from discocellular; 7 from upper angle. Antennæ pectinated.

Cyclara ovata, sp. nov.

Wings rather diaphanous brownish gray. Primaries with a darker basal shade and a median transverse dentate and irregular brown line outwardly edged with white, which is more distinct on the inner half of the wing; a small subapical dark brown spot. Expanse 19 mm.

Habitat: São Paulo, S. E. Brazil.

Carama flavescens, sp. nov.

Body and primaries yellowish white. Secondaries white. The wings rather thinly scaled. Expanse 40 mm.

Habitat: São Paulo, S. E. Brazil.

Carama grisea, sp. nov.

Head and thorax brownish white. Abdomen grayish brown. Wings grayish brown, a white spot at the end of the cell on the primaries. Expanse ♂ 32 mm.

Habitat: São Paulo, S. E. Brazil.

Carama parva, sp. nov.

Entirely pure milky white. Expanse ♀ 30 mm.

Habitat: Castro, Parana.

Trochuda impura, sp. nov.

Head and thorax yellowish. Abdomen white, subdorsally fawn color. Primaries whitish yellow; two oblique parallel brownish lines, one at a third from the base, the other from the apex to the middle of the inner margin. Secondaries white. Expanse ♀ 43 mm.

Habitat: São Paulo, S. E. Brazil.

Megalopyge lapena, sp. nov.

Body whitish gray, with indistinct transverse brown shades. Primaries very pale brownish gray, whiter beyond the cell and between the veins near the outer margin; at the end of the cell a small reddish brown spot; below the median vein a large reddish brown spot composed of long crinkly scales. Secondaries and underneath yellowish white. Expanse ♂ 35 mm.

Habitat: Jalapa, Mexico.

Megalopyge fieldia, sp. nov.

♂. Head white, brown behind. Collar white anteriorly, brown posteriorly. Thorax brown edged with white in front and with two white tufts posteriorly. Abdomen brown with a subdorsal row of white tufts. Primaries with the basal half brown except the costa which is white with a few long brown streaks; a dark brown spot at the end of the cell; the outer half of the wing brown with the veins whit sh and two transverse white lines breaking the brown up into irregular spots; there are also some white longitudinal streaks between the veins on the outer margin. Secondaries brown; white at the base of the costal margin; some whitish spots on the fringe. Underneath brown, some; white marginal streaks; the inner margin of the primaries broadly white. Expanse 45 mm.

Habitat: São Paulo, S. E. Brazil.

Megalopyge vipera, sp. nov.

♀. Head brown. Collar white. Thorax brown. Abdomen brown with a few grayish scales subdorsally. Primaries brown, the basal two-thirds with crinkly white scales along the costa, and transverse brownish streaks to the inner margin, and a dark brown spot at the end of the cell as in *M. albicollis* Walk.; the outer margin broadly grayish brown without markings. Secondaries grayish brown. Underneath dull brown. Expanse 53 mm.

Habitat: São Paulo, S. E. Brazil.

This species is very closely allied to *M. albicollis* Walk., which is placed by Kirby as a synonym of *M. nuda* Stoll, but *M. nuda* is quite distinct, as I have seen specimens in the collection of Mr. Oberthür which agree perfectly with Stoll's really excellent figure.

Megalopyge trujillo, sp. nov.

♂. Head cream color; palpi black. Body brown. Primaries brownish gray; a large white spot at the base, a smaller one at the end of the cell connected with the basal spots by a white line; an outer transverse irregular white band between which

and the median nervure the veins are whitish; fringe cream color. Secondaries creamy with the veins and some scales at the base darker.

♀. Almost entirely smoky brown; the fringe cream color; at the base and near the apex of the primaries some white scales; the median space mottled with blackish crinkly scales. Expanse ♂ 34 mm. ♀ 50 mm.

Habitat: Orizaba, Mexico.

Named after my assistant collector, Mateo Trujillo.

Citheronia aroa, sp. nov.

Head and thorax reddish, the latter yellow beneath the patagiæ. Abdomen red with transverse yellow bands. Primaries above mouse gray; a bright yellow spot at the base; an orange spot in the cell and a large similar spot below the median vein; an outer row of orange spots from near the apex to the inner margin, followed by a broad irregular orange band. Secondaries orange, shaded with red at the base; a red spot in the cell and a narrow transverse dark red line, shaded with gray at the anal angle. Underneath the markings are the same as in *C. mexicana* Grote & Rob., to which this species comes nearest. Expanse ♂ 85 mm.

Habitat: Aroa, Venezuela.

Citheronia azteca, sp. nov.

Head red with some white hairs under the antennæ. Collar white, broadly margined with red posteriorly. Thorax red with three yellow lines. Abdomen red; a large white subdorsal spot at the base and a fine yellowish band posteriorly on each segment. Primaries gray with all the veins broadly red; at the base two creamy spots; a similar spot at the end of the cell and an outer row of transverse creamy spots between the veins; fringe on the inner margin red. Secondaries above bright yellow, the veins red; a large red space at the base and a red spot at the end of the cell; a transverse narrow gray shade to the anal angle and some grayish spots between the veins on the outer margin. In the ♀ the secondaries have the yellow replaced by gray with two wavy yellow transverse bands. Expanse ♂ 105 mm. ♀ 108 mm.

Habitat: Jalapa, Mexico.

Allied to *C. splendens* Druce, but quite distinct.

Adelocephala acuta, sp. nov.

Body pinkish fawn color. Primaries very acute at the apex, reddish fawn color shaded with lilacine at the base and on the outer margin; two fine transverse brown lines, one from near the middle of the costa to the inner margin at a third from the base, the other from the apex to the inner margin at two-thirds from the base; in the cell an indistinct grayish spot containing a minute white point. Secondaries reddish fawn color with a large cluster of dark red hairs on the inner margin. Underneath the primaries are orange with a triangular gray space occupying the outer margin and a large black spot with a white point at the end of the cell. Secondaries fawn color with an indistinct transverse line. Expanse ♂ 55 mm.

Habitat: Aroa, Venezuela.

Heliconisa catherina, sp. nov.

Body fawn color; antennæ black. Wings with the basal two-thirds fawn color, becoming diaphanous outwardly; the outer third of the wings black with some indistinct brownish streaks between the veins; a brownish spot at the end of the cells. Expanse ♂ 100 mm.

Habitat: Santa Catherina, S. E. Brazil.

Dirphia bertha, sp. nov.

Head reddish. Thorax black, the patagiæ edged with yellow. Abdomen red in the ♂, brownish in the ♀. Primaries above very dark gray; all the veins orange edged on either side with pale yellow; a yellowish streak in the cell, and another between the median and submedian veins; at the end of the cell a small dark red spot circled with black. Secondaries in the ♂ red with long yellow hairs at the base; the outer margin black interrupted by yellow veins; fringe yellow; a large black spot with a brownish centre crossed by a white line at the end of the cell. In the ♀ the secondaries are pinkish shading to gray on the outer margin, where the veins are tinged with yellow; the discal spot as in the male. Underneath the wings are dull gray in the ♀ with yellowish veins; in the ♂ the primaries below are red and the disc of the secondaries yellowish with broad black margins, all the veins being yellowish. Expanse ♂ 88 mm. ♀ 74 mm.

Habitat: Castro, Parana.

I name this beautiful species Bertha in honor of the wife of E. D. Jones, Esq., who has done so much to give us a knowledge of the fauna of Southeast Brazil.

Dirphia taglia, sp. nov.

Head and thorax brown, the latter with a few white hairs. Abdomen red dorsally, whitish laterally and underneath. Primaries brown; near the base three lilacine transverse bands; a dark spot in the cell; a dentate outer brown line shaded on either side with lilacine; a subterminal brownish indistinct line beyond which the outer margin is lilacine gray. Secondaries brown with an outer and a submarginal wavy lilacine band; at the end of the cell a large dark spot containing some lighter scales and circled with yellow. Underneath light brown, both wings crossed by an outer lilacine band and the outer margins are broadly lilacine. Expanse ♀ 74 mm.

Habitat: São Paulo, S. E. Brazil.

Allied to *Dirphia perdix* Massn.

THE PHOSPHORESCENT ORGANS OF INSECTS.

BY A. S. PACKARD.

The nature of the phosphorescent organs and their physiology has never seriously engaged the attention of students in this country, and I have thought that some account compiled from the latest and best researches might stimulate inquiry in this country, where fire-flies are universally common.

Phosphorescence is not infrequent in the Protozoa, Cœlenterates, Worms, and has been observed in the bivalve Pholas, in a few abyssal Crustacea, in Myriopods (*Geophilus*), in an Ascidian, Pyrosoma, and in certain deep-sea fishes.

In insects luminosity is mostly confined to a few Coleoptera, and besides the well-known fire-flies, an Indian Buprestid (*Buprestis ocellata*) is said to be phosphorescent; also a Telephorid larva. Other luminous insects are the Poduran *Anurophorus*, *Fulgora*, and certain Diptera (*Culex* and *Tyreophora*).

The seat of the light is the intensely luminous areas situated either in the head (Fulgora), in the abdomen (Lampyridæ), or in the thorax (in a few Elateridæ of the genus Pyrophorus). The luminous or photogenic organ is regarded by Wielowiejsky and also by Emery as morphologically a specialized portion of the fat-body, being a plate consisting of polygonal cells, situated directly under the integument, and supplied with nerves and fine tracheal branches.

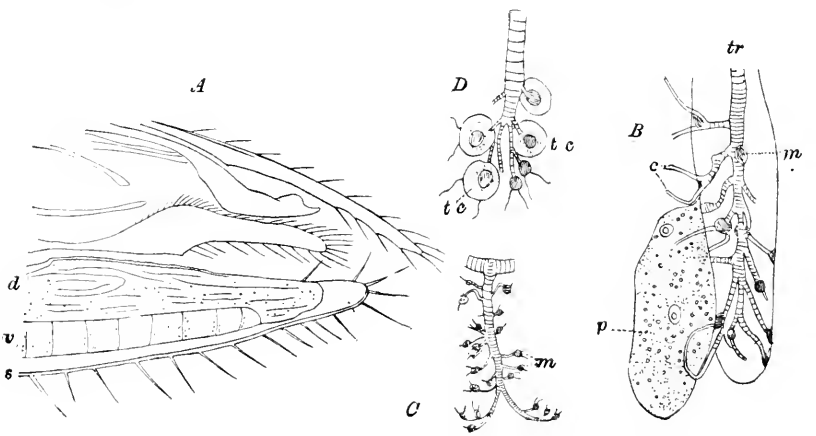

Fig. A. Sagittal section through the hinder end of a male *Luciola*; the organs above the phosphorescent plate only drawn in outline. *s*, integument of the last segment, somewhat removed by the section-knife from the phosphorescent tissues.

d, dorsal layer of the phosphorescent plate penetrated by irregular tracheal branches, and rendered opake by numerous urate concretions imbedded in it; *v*, ventral phosphorescent layer of the plate, with perpendicular tracheal stems whose branches, where they pass into capillaries bear lumps which stain brown with osmic acid. *n*, structurless substance (coagulum?) filling the end of the last ventral segment. B. Isolated portion of the ventral layer of the phosphorescent plate, *tr*. tracheal stem surrounded by a cylindrical lobe; *p*, parenchym cell attached to the cylinder; *c*, capillary, without the spiral threads; *m*, coagulum stained brown. C. a tracheal stem of the ventral layer: at the fork of the brown-stained capillaries are lumps stained brown with osmic acid. D. a part of C. more highly magnified showing the remains of the tracheal end-cells (*tc*) enveloping the brown lumps (*m*)—after Emery.

In *Luciola* as well as in other fire-flies, including *Pyrophorus*, the phosphorescent organ or plate consists, as first stated by Kölliker, of two layers lying one over the other a dorsal one (*d.*) which is opake, chalky white, and non-photogenic, and a lower one (*v.*), the active photogenic layer, which is transparent. Through the upper or opake layer and on its dorsal surface extend large tracheæ and their horizontal branches, from which arise numerous very fine branches which pass down perpendicularly into the transparent or photogenic layer of the organ. Each tracheal stem, together with its short branches is enveloped by a cylindrical mass of transparent tissue, so that only the short terminal branches or very fine tracheal capillaries project on the upper part of the cylinder. These finest tracheal capillaries are not in *Luciola* filled with air, but with a colorless fluid, as was also found by Wielowiejsky and others in Lampyris.

These transparent cylinders, with the tracheæ within, forming longitudinal axes, resemble lobules. These lobules are so distributed that they appear on a surface section of this plate as numerous round areas in which circular periphery the tracheal capillaries are arranged with the axially disposed tracheal end-cells. These "tracheal end-cells" are only membranous enlargements at the base of the tracheal capillaries (Wielowiejsky). The cylindrical lobules are separated from each other by a substance consisting of abundant large granular cells (parenchym cells) among which project the tracheal capillaries. The cylindrical lobules extend to the hypodermis and come in contact only by their lateral faces with the parenchym.

The structure of the upper opake chalky white layer of the phosphorescent organ is, compared with that of the photogenic lower portion, very simple. In its loose, pappose, mass are no cellular elements, but when treated with different reagents it is seen to be filled with countless urate granules (guanine) swimming in the fluid it contains,

the cell plasma appearing to be dissolved, the cells having lost their cohesion.

In comparing the phosphorescent plate or organ of *Luciola* with that of *Lampyris*, the general structure, including the clear cell elements of the cylindrical lobules, which envelop the perpendicular tracheal twigs and their branches, and also the granular parenchymatous cells are alike in both, though the arrangement and distribution of the elements in *Luciola* is more regular, in *Lampyris* the tracheal stems being irregularly scattered through the parenchym.

Wielowiejsky found in the larval and female *Lampyris* a higher degree of differentiation than in the male, and *Luciola* has a more differentiated photogenic organ than *Lampyris*, as seen in the more regular structure of the lobules.

As regards the light apparatus of *Pyrophorus*, or the cucujo, Heinemann shows and that as in the Lampyridæ, it consists of distinct cells may be regarded as a glandular structure. It is rich in tracheæ and the other parts already described. In still later researches on a Brazilian *Pyrophorus* Wielowiejsky shows that the phosphorescent plate consists of two layers, the upper usually being filled with crystalline urate concretions, and entirely like those of the Lampyridæ, consisting of distinct polygonal cells, among which are numerous tracheal stems, with tænidia, and coursing in different directions, when freshly filled with air, and sending capillaries into the underlying photogenic layer. The latter shows in its structure a striking difference in the cellular arrangement from that of Lampyrids. In the upper or non-photogenic layer are tracheal capillaries which pass down into the underlying cellular plate and which are in the closest possible relations with the single cells, a point overlooked by Heinemann.

PHYSIOLOGY OF THE PHOSPHORESCENCE.

As is well known, the phosphorescence of animals is a scintillating or glowing light emitted by various forms, the greenish light or luminous appearance thus produced being photogenic, *i. e.*, without sensible heat.

Langley rates the light of the firefly at an efficiency of 100 per cent., all its radiations lying within the limits of the visible spectrum. "Langley has shown that while only 2.4 per cent. of luminous waves are contained in the radiation of a gas-flame, only 10 per cent. in that of the electric arc, and only 35 per cent. in that of the sun, the radiation of the fire-fly (*Pyrophorus noctilucus*) consists wholly of visible wave-frequencies." (Barker's Physics, p. 385.)

The spectrum of the light of the cucujo was found by Pasteur to be continuous. (C. R. French Acad. Sc. 1864, ii, p. 509.) A later examination by Aubert and Dubois, showed that the spectrum of the light, examined by the spectroscope is very beautiful, but destitute of dark bands. When, however, the intensity diminishes, the red and orange disappear, and the green and yellow only remain.

Heinemann studied the cucujo at Vera Cruz, Mexico. At night in a dark room it radiates a pale green light which shows a blue tone to the exclusion of any other light. The more gas or lamp light there is present, the more apparent becomes the yellowish green hue, which in clear daylight changes to an almost pure very light yellow with a very slight mixture of green. "In the morning and evening twilight, more constantly and clearly in the former, the cucujo light, at least to my eyes, is an intensely brilliant yellow with a slight mixture of red. In a dark room lighted with a sodium light the yellow tone entirely disappears: on the other hand the blue strikingly increases." As regards the spectrum he found that almost exactly half of the blue end is wanting and that the red part is also a little narrower than in the spectrum of the petroleum flame.

Prof. C. A. Young states that the spectrum given by our common firefly (*Photinus?*) is perfectly continuous, without trace of lines either bright or dark. "It extends from a little above Fraunhofer's line C, in the scarlet, to about F in the blue, gradually fading out at the extremities. It is noticeable that precisely this portion of the spectrum is composed of rays, which while they more powerfully than any others affect the organs of vision, produce hardly any thermal or actinic effect. In other words, very little of the energy expended in the flash of the fire is wasted. It is quite different with our artificial methods of illumination. In the case of an ordinary gas light the best experiments show that not more than one or two per cent. of the radiant energy consists of *visible rays;* the rest is either invisible heat or actinism; that is to say, over 98 per cent. of the gas is wasted in producing rays that do not help in making objects visible." (Amer. Nat. iii, 1870. p. 615).

Panceri also remarks that while in the spectroscope the light of some Chætopteri, Beroë and Pyrosoma, exhibit one broad band like that given by monochromatic light, that of *Lampyris* and *Luciola* is polychromatic (Amer. Nat. vii, 1873, p. 314.)

The physiology of insect-phosphorescence is thus briefly stated by Lang: "The cells of this luminous organ secrete, under the control of the nervous system, a substance which is burnt during the appearance of the light; this combustion takes place by means of the oxygen con-

veyed to the cells of the luminous body by the tracheæ, which branch profusely in it and break up into capillaries."

Emery states that the males of *Luciola* display their light in two ways. When at night time they are active or flying the light is given out at short and regular intervals, causing the well-known sparkling or scintillating light. If we catch a flying *Luciola* or pull apart one resting in the day time, or cut off its hind body, it gives out a tolerably strong light, though not nearly reaching the intensity of the light-waves of the sparkling light. In this case the light is constant, yet we notice, especially in the wounded insect, that the phosphorescent plate in its whole extent is not luminous, but glows at different places as if phosphorescent clouds passed over it.

It is self-evident that a microscopic observation of the light of the glow-worm or fire-fly is not possible, but an animal while giving out its light, or a separated abdomen, may readily be placed under the microscope and observed under tolerably high powers. By making the experiment in a rather dark room Emery saw clear shining rings on a dark background. "All the rings are not equally lighted. Comparing this with the results of anatomical investigation, and it is seen that the rings of light correspond with the previously described circular tracheal capillaries, *i. e.*, the limits between the tracheal-cell cylinder and the parenchym-cells. The parenchym-cells are never stained of a deep brown; this proves that its plasma may be the seat of the light-producing oxydation. Hence this process of oxydation takes place in the upper surface of the parenchym-cells, but outside of their own substance. The parenchym-cells in reality secrete the luminous matter; this is taken up by the tracheal end-cells and burnt or oxydized by means of the oxygen present in the tracheal capillaries. Such a combustion can only take place when the chitinous membrane of the tracheae is extraordinarily fine and easily penetrable, as is the case in the capillaries of the photogenic plate; therefore the plasma of the tracheal cells only oxydizes at the forking of the terminal tracheal twigs and in the capillaries." (Emery.)

The color of the light of *Luciola* is identical in the two sexes, and the intensity is much the same, though that of the female is more restricted. The rhythm of the flashes of light given out by the male is more rapid, and the flashes briefer, while those of the female are longer, more tremulous and appear at longer intervals.

Emery then asks: What is the use of this luminosity? Is it only to allure the females of *Luciola*, which are so much rarer than the males? Contrary to the general view that it is an alluring act, he thinks that phosphorescence is a means of defense, or a warning or danger-signal

against insectivorous nocturnal animals. If we dissect or crush a *Luciola* it gives out a disagreeable cabbage-like smell, and perhaps this is sufficient to render it inedible to bats or other nocturnal animals. An acrid taste they certainly do not possess.

It has long been known that the eggs of fire-flies, both Lampyridæ and *Pyrophorus*, are luminous. Both Newport and more recently Wielowiejsky attributes the luminosity not to the contents of the egg, but to the portions of the fat-body cells or fluid covering on the outside of the eggs, due to ruptures of the parts within the body of the female during oviposition. The larvæ at different ages are also luminous.

The position of the luminous organs changes with age. In the larvæ of *Pyrophorus* before moulting, according to Dubois, the luminous organs are situated only on the ventral side of the head and prothoracic segment. In larvæ of the second stage there are added three shining spots on each of the first eight abdominal segments, and a single luminous spot on the last segment. These spots are arranged in a linear series and thus form three luminous cords. In the adult beetles there is a luminous spot in the middle of the first abdominal sternite, but the greatest amount of light is produced by the two vesicles on the hinder part of the prothorax, the position of which varies according to the species.

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THE PROBABLE ORIGIN AND DIFFUSION OF NORTH AMERICAN SPECIES OF THE GENUS DIABROTICA.—II.

BY F. M. WEBSTER.

Since the publication of my paper in No. 4, Vol. III, of the JOURNAL, a considerable amount of information relative to the subject has since either been communicated to me, or placed at my disposal where I did not before feel at liberty to use in print. I have, therefore, thought best to add this supplementary note, including in it a few corrections.

Professor Cockerell has very kindly prepared the following table illustrating the position of his *D. vittata* var. *incerta*, Ckll. found by him from Mesilla Valley southward to Juarez, Mexico, opposite El Paso, Texas, on the Rio Grande:

A. Antennæ with the three basal joint pale.

a. "Legs yellow, the knees, anterior tibiæ and tarsi, and the tips of the middle and posterior tibiæ and their tarsi, piceous." (Horn). **vittata** *Fab.*

b. Legs more or less darkened, but basal third of anterior femora, and basal two-thirds of middle and posterior femora, and hind tibiæ more or less in middle, yellow. **vittata** var. **incerta** *Ckll.*

B. Antennæ all black. Legs all black except bases of femora. **trivittata** *Mann.*

In regard to the distribution of these in the valley of the Rio Grande, Prof. Cockerell gives me the following table:

7,000 ft.	Santa Fé,	*D. 12-punctata*, (1 specimen not taken by himself).
	Gallinas Cañon,	*D. atripennis*, (reported by the Snow party).
*5,000 "	Albuquerque,	. . . . . *D. longicornis.*
*5,000 "	Socorro,	*D. 12-punctata*, . . *D. lemniscata.* Collected by Prof.
3,000 "	Mesilla Valley,	Wickham, at Alberquerque.
*3,— "	Juarez, Mexico,	*D. tricincta.*
		D. vittata var. *incerta.*

The occurrence at Gallinas Cañon should have been credited to Prof. Snow and not to Prof. Cockerell. Prof. Wickham calls my attention to the fact of Dr. Horn's having observed a close resemblance between *Andrector 6-punctata* Horn, and *Diabrotica 12-punctata* Oliv., while he had himself confused a second species of *Andrector* with *Diabrotica tricincta* Say, and placed them in his collection as all be-

* These records of elevations are supplied by myself and taken from surveys made by the U. S. Geological Survey and published in 1890. The elevation of Juarez, Mex., opposite El Paso, Tex., is but little less than 3,800 ft.

longing to the latter species. *Andrector* is placed in the same sub-tribe as *Cerotoma* and *Diabrotica*, which would rather oppose the idea of a protective mimicry, though by no means disproving it. We simply need more information in regard to the matter as all may be alike inedible.

Since my paper was published, I have found the larvæ of *Diabrotica vittata* so excessively abundant in some greenhouses near Cincinnati, as to entirely ruin the cucumber vines being grown therein. The date of my observations was December 28, and at that time I found adults, and larvæ from one-half to two-thirds grown, but mostly the former.

ON THE PROBABLE ORIGIN OF THE PERICOPIDÆ: COMPOSIA FIDELISSIMA *H.-S.*

By HARRISON G. DYAR, A. M., Ph.D.

The Pericopidæ are a tropical American family of moths with the venation of Noctuidæ, most allied in their colors, perhaps, to the Dioptidæ. Three genera occur in our fauna, *Gnophæla*, *Composia* and *Daritis*.

In placing the North American families in systematic position on their larval characters, I was able to show from the writings of Bruce and Cockerell that the abdominal tubercles of *Gnophæla* were the same as in the Arctiidæ; but was unable to get further in the absence of material and the unfortunate brevity of the published descriptions. Now, however, I have obtained many larvæ of *Composia*, and have been able to rear them by the kind assistance of Mr. F. Kinzel. They were found on the vines of *Echites umbellata* (determined by Mr. Kinzel) at Palm Beach, Florida, during the Christmas holidays. *Composia* is a moderately specialized Pericopid type, and its larvæ may be supposed to be characteristic of the family. The following are the larval characters:

Warts many haired, simple, not tufted, the arrangement as in the Arctiidæ, but with a distinct tendency to the coalescence of the two upper warts on the meso- and post-thoracic segments. Primitive first stage present, wart formation not highly specialized, head setæ very simple, no secondary hair formation. Body long, cylindrical, Noctuidous rather than Arctiiform, joint 12 slightly enlarged.

As to the origin of this family, three alternatives seem possible: (1) from the Arctiidæ (2) from the Noctuidæ (3) from the Dioptidæ.

(1). This alternative seemed to me at first sight most plausible. However, the subcostal vein of secondaries in the Pericopidæ is free from the radius and the wart formation of the larva is of a simple type. Therefore, if of Arctiid origin, they are a branch representing a more generalized type than the present Arctiidæ. But no confirmatory evidence for this possible origin occurs to me.

(2). By pushing the origin a little further back, we reach a derivation from the Noctuidæ. This involves an independent wart formation from that in the Arctiidæ; that is that we may suppose that the Arctiidæ and Pericopidæ arose simultaneously, or nearly so, from Noctuid ancestors, but independently and with separate larval wart formation, the Pericopidæ remaining the more generalized. I do not think of any confirmatory evidence for this view.

(3). The Pericopidæ and Dioptidæ differ in that in the former cubitus is four-branched while three-branched in the latter. This distinction is not sharp, since in *Gonora heliconiata* (a Pericopid) vein 5 arises only a short distance below the fold representing media. In *Dioptis pheloides*, *Phryganidia californica* and *Tithraustes haemon* (Dioptidæ), vein 5 is a distinct continuation of medial fold. The families almost intergrade, as the confusion in the genera in Kirby's catalogue bears witness.

The larvæ of the Dioptidæ (only known to me in Phryganidia) have single Noctuidous setæ. To derive the Pericopidæ from them, we must suppose an independent wart formation analogous to that of the Apatelidæ from the Noctuidæ or the Eupterotidæ from the Notodontidæ, but simpler than either.

Now as confirmatory evidence, we have in the moths the marked similarity in build and pattern of coloration; also a tendency in both families to the coalescence of veins 3 and 4, not seen in the Noctuidæ and Arctiidæ. The Noctuid habitus of the larva is also equally consonant with an origin from the generalized Noctuiform Dioptid larva as from any existing type of the Noctuidæ.

I think that we may conclude, therefore, that the Pericopidæ are a family representing a specialized form of Dioptidæ, with independent moving of vein 5 toward 4 and wart formation in the larvæ. Their geographical distribution is also in favor of this conclusion, since, being confined to America, their origin from the strictly American Dioptidæ is more reasonable than from either of the world wide Noctuidæ or Arctiidæ.

Finally a word concerning the origin of the Dioptidæ to trace the ancestry a step further. In this Journal (Vol. iii, p. 30–32), Dr. Packard argues for the derivation from a common ancestor of the "Geometrids, Dioptids, Hypsids and Syntomids"=Euchromiidæ. It is true he makes this ancestor to be the Lithosiidæ, why I am unable to imagine. We have no evidence of the extensive degeneration which is implied in deriving the simple Geometrids and Hypsids (a low Noctuidous type) from the highly specialized Lithosiidæ, with their four-branched cubitus and modified wart formation in the larvæ. To my mind, the present group nearest to the ancestral form of the Noctuina (which includes the four families mentioned by Dr. Packard) is the Notodontidæ.* We see in them a combination of the generalized position of vien 5 with the single haired tubercle of the larva. The two families next nearest this stem are the Dioptidæ on one side and the Geometridæ on the other. Therefore I agree with Dr. Packard's main proposition, and we may derive the Dioptidæ from low on the main stem of the Noctuina, near the ancestors of the Geometrids, as illustrated in the genealogical tree shown on the accompanying plate (Plate III, fig. 9).

COMPOSIA FIDELISSIMA: ITS LIFE HISTORY.

1866—Herrich-Schäffer, Cor. Blatt. Reg. XX, 131.
1867—Grote, Proc. Ent. Soc. Phil. VI, 303.
1890—Dyar, Ent. News, I, 105.
1891—Dyar, Ent. News, II, 50.
1892—Kirby, Cat. Lep. Het. I, 190.
1894—Neumoegen & Dyar, Journ. N. Y. Ent. Soc. II, 26.
Composia olympia BUTLER.
1871—Butler, Ann. Nat. Hist. (4) VIII, 290.
1884—Druce, Biol. Cent. Am. pl. 11, fig. 1.
1890—French, Ent. News, I, 153, fig.

Eggs.—Large, spherical, except for the flattened base; deep ocher yellow, slightly shining. Diameter 1.3 mm.; height .9 mm. The reticulations are small, rounded hexagonal, visible under a half inch objective. (Plate III, fig. 1). Twenty-four eggs were found on the back of a single leaf, irregularly distributed and rather remote from each other.

Stage I.—Head rounded, shining, concolorous with the body; width .5 mm. Body dull orange, segments 5–6, 9–11 reddish purple;

* In some characters the Dioptidæ themselves are more generalized than the Notodontidæ, e. g., the presence of traces of a third anal vein in hind wings as shown by Prof. Comstock; but on the whole they must rank a little higher.

warts dusky, those on the purple segments blue-black; thoracic feet and leg plates black; hair black, strong and stiff, singly from the warts, spinulated and pointed. The arrangement of the tubercles is normal for the primitive first stage of the Noctuina. (Plate III, fig. 2).

Stage II.—Head .8 mm. Warts many haired, the hairs black except a pair of long white ones which overhang the head, arising from the upper wart on joint 3. The warts have a central hair and radiating crown of secondary hairs except iv, which is single haired. Wart vi present, large. On the thorax there are two warts above the stigmatal wart closely approximated. The coloration is as before.

Stage III.—Head 1.1 mm. The dark segments of the body are mottled by the general orange tint; otherwise as before. This differs from the next stage in being more decidedly orange, the blackish shadings more livid.

Stage IV.—Head 1.6 mm. Like the mature larva.

Stage V.—Head 2.2 mm. No change except in size.

Stage VI.—Head 2.8 mm. From the width of the head this is an interpolated stage, but it was persistently passed through by all the larvæ observed at first. Later some examples of a brood omitted it and in these the width of head in Stage V was about 2.5 mm

Stage VII.—General appearance beautiful bright crimson and shining violet blue, sparsely hairy. Head and body crimson red, not shining; warts shining red, certain of them shining violet-blue, the areas around these warts discolored, blackish. Spiracles pale orange. On joints 2 to 4, only the two lowest warts bluish; on 5, 6, 9, 10 and 11 all the warts blue, the blackish shades predominating subdorsally; on joints 7, 8 and 12 warts iv to vi bluish. This distribution of color is subject to some variation. Hairs sparse, only 8–10 to a wart, stiff, barbuled, rather short, black; from wart i on joint 3 and from i on joint 13 a single stiff white hair, four times as long as any other, projects forward and back, probably serving as a tactile organ. In many instances one or both of the posterior hairs are missing. Warts i to vi and leg-plate normal, iv rather small; on joint 3, i and iia nearly fused but separable, more remote on 4; ii*b* rudimentary, a single hair; iii a single hair; iv + v and vi normal warts; on joint 2, hairs from the anterior and posterior edges of cervical shield, a wart before the spiracle and a subventral wart. Head setæ simple (Plate III, fig. 4); width 3.2—3.4 mm. The mature larva is figured on the plate (fig. 3).

Cocoon.—This can scarcely be called such. It consists of a few threads which serve to entangle the hooks on the head and cremaster.

Pupa.—(Plate III, fig. 5). Cases large, compacted, a large prominent knob at the base of the wing case; abdomen small, conically tapering, but enlarged on the dorsal side toward the base; three moveable incisures. The lines of the wing veins and the abdominal segments are marked by punctures. Corresponding to the position of the larval warts and to the legs are a series of tufts of flattened straw-colored scales. Two pairs of hooks on the head (Plate III, fig. 8), and many strong ones on the cremaster (Plate III, fig. 7). The color is a rich mahogany red with blue and violet shadings especially on the wing cases. Length 20, width 7 mm.

Food Plant.—The leaves of *Echites umbellata*. Kindly determined by Mr. F. Kinzel, to whom I am also indebted for a supply of the plant. In confinement the larvæ will also eat oleander, but did not occur on this plant in nature. Mrs. Slosson informs me that she has found the larvæ on *Canavalia obtusa*.

Habitat.—This species reaches us from Brazil, being found also in Central America and the West Indies. It is abundant in Key West, as I learn from Mr. Brownell, and its northernmost record is on the strip of land between Indian River and the sea. Eggs, larvæ in all stages and moths were found at the same time, and the species doubtless breeds continuously.

THE LARVA OF SYNTOMEIDA EPILAIS *Walk.*

BY HARRISON G. DYAR.

This larva was met with on the oleander at Palm Beach, Florida, in January, 1890, and again in the same place in 1896. Its life history will be found described in the second volume of "Insect Life," page 360, and the object of the present note is to call attention to the figure on the plate (Plate III, fig. 10).

The hair tufting of this larva is decidedly unusual. All the hair tufts are gathered into slender pencils, not spreading tufts as usual, so that here the body is entirely exposed to view. Some of these hair pencils are long, others very short and warts iv and v are much reduced, nearly obsolete.

EXPLANATION OF PLATE III.

Fig. 1. Egg of *Composia fidelissima* enlarged · 20.
" 2. Larva, stage I · 18.
" 3. Mature larva, natural size.
" 4. Front view of the head · 10, showing the setæ.
" 5. Pupa, slightly enlarged.
" 6. A group of scales from the body of the pupa · 40.
" 7. Some of the hooks of the cremaster · 30.
" 8. One of the head hooks · 40.
" 9. Genealogical tree of the Lepidopterous superfamily Noctuina, showing the probable origin of the North American families from a Tineid stock. The European Lemoniidæ are included as a connecting link. The narrow cross bars indicate points at which cubitus became 4-branched on the fore wings; the broad shaded bars, points at which the larva-tubercles became warts.
" 10. Mature larva of *Syntomeida epilais*, natural size.

FOOD-HABITS OF NORTH AMERICAN CERAMBYCIDÆ.

BY WILLIAM BEUTENMULLER.

In the American Entomologist, Vol. III, 1880, pp. 237 and 270, the late Dr. C. V. Riley published a paper on the food-habits of the long-horn beetles or wood-borers. Since then considerable has been added to our knowledge on the food-habits of this family of beetles. It has therefore been deemed advisable to republish Dr. Riley's paper with such additions which have been made. For personal credit the reader is referred to Dr. Riley's paper and Packard's Fifth Report U. S. Entomological Commission. We are also indebted to Mr. L. H. Joutel for many notes incorporated in the present paper and which have not been published elsewhere.

Ergates spiculatus *Lec.*—This western species is recorded as living in the roots of coniferous trees, especially pine.

Mallodon dasystomus *Say.*—Bores in the wood of oak, hackberry (*Celtis*) and pecan hickory, and undoubtedly other species of hickory.

Mallodon melanopus *Linn.*—Lives in box elder (*Negundo aceroides*), oak and hackberry (*Celtis*).

Mallodon serrulatus *Lec.*—Breeds in hackberry (*Celtis*), and probably also oak.

Orthosoma brunneum *Forst.*—Bores in decaying pine, hemlock and probably other coniferous trees, also in hickory, walnut, oak and chestnut.

Prionus laticollis *Drury.*—Lives in the trunks and roots of linden poplar, oak, chestnut, apple, pine and grapevine.

Prionus californicus *Mots.*—Breeds in decaying stumps and roots of live-oak.

Prionus pocularis *Dalm.*—Infests the roots and stumps of pine.

Prionus imbricornis *Linn.*—Lives in roots of grapevine, pear trees and herbaceous plants.

Homoæsthesis emarginatus *Say.*—Is supposed to live in trunk and roots of pine.

Tragosoma harrisii *Lec.*—Breeds in stumps of decaying pine trees.

Asemum mœstum *Hald.*—Lives under and in the bark of oak, pine, spruce and other conifers and also in roots of grapevine.

Asemum atrum *Esch.*—Bores in the trunk of pine trees.

Criocephalus nubilus *Lec.*—Lives in the roots of pine, as does *C. agrestis* Kby., and probably also the other species of the genus.

Smodicum cucujiforme *Say.*—Breeds under bark of oak, hackberry and beech.

Physocnemum brevilineum *Say.*—Lives in dry wood of elm trees.

Hylotrupes bajulus *Linn.*—Inhabits fir, spruce, pine, hemlock and other coniferous trees.

Hylotrupes li gneus*Fab.*—Bores under the bark of cedar (*Juniperus*).

Phymatodes variabilis *Fabr.*—Lives under bark and in the branches of oak and hickory.

Phymatodes varius *Fabr.*—This species like *P. variabilis*, also lives in oak and hickory.

Phymatodes amœnus *Say.*—Bores in dead wood of grapevine.

Phymatodes obscurus *Lec.*—Has been bred from branches of live-oak in California.

Callidium antennatum *Newm.*—Breeds under the bark of pine and cedar (*Juniperus*), making tortuous galleries.

Callidium janthinum *Lec.*—Lives under bark of pine.

Callidium æreum *Newm.*—Has been bred from chestnut logs.

Oeme gracilis *Lec.*—Lives in dead wood of oak (*Quercus agrifolia*) in California.

Dryobius sexfasciatus *Say.*—Lives in oak and beech, under the bark.

Gracilia minuta *Fabr.*—Breeds in the wood of the sweet birch (*Betula lenta*). Raised from oak twigs by Mr. Joutel.

Chion cinctus *Drury.*—Bores in the trunk of hickory.

Eburia 4-geminata *Say.*—Lives in the trunk of honey-locust, hickory and probably also in ash.

Romaleum atomarium *Dr.*—Bores in the twigs of oak, hackberry (*Celtis*), and in the dry leaf stems of palmetto.

Elaphidion inerme *Newm.*—Bores in the twigs of oak and orange.

Elaphidion mucronatum *Fabr.*—Bores in twigs of oak, hackberry, palmetto and grapevine.

Elaphidion parallelum *Newm.*—Breeds in twigs of oak, hickory plum, apple and grape.

Elaphidion villosum *Fabr.*—Lives in the twigs of oak, hickory, beech, chestnut, birch, sumac, plum, apple and grapevine.

Elaphidion irroratum *Fabr.*—Bores in the trunk of black mangrove in Florida.

Tylonotus bimaculatus *Hald.*—Found under bark of tulip tree, also lives in ash and dead hickory.

Heterachthes 4-maculatus *Newm.*—Breeds in branches of hickory.

Phyton pallidium *Say.*—Lives in branches of hickory.

Megobrium edwardsii *Lec.*—Lives in wood of live-oak in California.

Molorchus bimaculatus *Fabr.*—Has been bred from hickory branches, also bores in maple twigs.

Callichroma splendidum *Lec.*—Breeds in wood of gum-elastic tree in Texas.

Megaderus bifasciatus *Dup.*—Has been taken from cedar timber in Texas.

Tragidion coquus *Linn.*—Bores in oak.

Tragidion armatum *Lec.*—Breeds in the flower stalks of *Yucca angustifolia* (Townsend).

Purpuricenus humeralis *Fabr.*—Lives in oak stumps.

Schizax senax *Lec.*—Lives in dead wood of apricot.

Stenophenus notatus *Oliv.*—Breeds in dead hickory limbs.

Cyllene antennatus *White.*—Lives in the wood of mesquite in Arizona.

Cyllene picta *Drury.*—Bores in the solid wood under the bark of hickory, walnut, butternut and occasionally in the honey-locust (*Gleditschia*).

Cyllene robinæ *Forst.*—Very destructive to the trunks of locust.

Cyllene crinicornis *Chev.*—Has been taken in Texas on sycamore (*Platanus*), in the wood of which the species probably breeds.

Plagionotus speciosus *Say.*—Lives in the solid wood of sugar maple.

Calloides nobilis *Say.*—Breeds in chestnut and oak trees; also beaten from hickory by Mr. Joutel.

Arhopalus fulminans *Fabr.*—Bores in the sap wood of chestnut and oak.

Xylotrechus annosus *Say.*—Breed in the wood of willow.

Xylotrechus convergens *Lec.*—Has been bred from a branch of a species of thorn (*Crataegus*).

Xylotrechus colonus *Fabr.*—Bores under bark of maple, oak and hickory.

Xylotrechus nauticus *Mann.*—Has been bred from dead branches of live-oak in California, also from *Eucalyptus*.

Xylotrechus undulatus *Say.*—Beaten from spruce (*Abies*) in the wood of which the species probably breeds.

Neoclytus erythrocephalus *Fabr.*—Breeds in trunk and branches of hickory, ash, elm, oak, chestnut and pine, also beaten from locust.

Neoclytus muricatulus *Kby.*—Breeds in the trunk and branches of pine.

Neoclytus luscus *Lec.*—Breeds in hickory limbs and probably also in the trunk of the tree.

Neoclytus capræa *Say.*—Bores in ash, elm and hickory, limbs and trunks.

Clytanthus albofasciatus *Lap.*—Lives in the limbs of hickory and in the wood of the grapevine. *C. ruricola* also breeds in hickory.

Microclytus gazellula *Hald.*—Bores in the branches of oak.

Cyrtophorus verrucosus *Oliv.*—Lives in the wood of wild red cherry and quince; has also been beaten from hickory.

Tillomorpha geminata *Hald.*—Has been bred from branches of hickory.

Euderces pini *Oliv.*—Occurs on pine trees.

Euderces picipes *Fabr.*—Has been raised from hickory and chestnut branches.

Zagymnus clerinus *Lec.*—Bores in the dry leaf stems of palmetto in Florida.

Atimia confusa *Say.*—Occurs on pine tree.

Distenia undata *Oliv.*—Bores in the wood of chestnut and hornbeam (*Carpinus*).

Desmocerus palliatus *Forst.*—Lives in the lower parts of the stems of elder. *D. auripennis*, also lives in the same plant.

Rhagium lineatum *Oliv.*—Lives under the bark of pine and spruce.

Anthophilax mirificus *Bland.*—Has been found under the bark of spruce (*Abies menziesii*).

Gaurotes cyanipennis *Say.*—Has been found ovipositing on butternut and oak.

Bellamira scalaris *Say.*—The beetle and pupa of this species have been taken under bark of the yellow birch (*Betula lutea*), also found ovipositing on maple.

Typocerus zebratus *Fabr.*—This species mines the oak.

Leptura zebra *Oliv.*—Inhabits the oak, chestnut and pine.

Leptura vagans *Oliv.*—Lives in wood of yellow birch (*Betula lutea*).

Leptura emarginata *Fabr.*—Has been found ovipositing in limbs of white oak by Mr. Joutel.

Leptura abdominalis *Hald.*—Lives in the wood of red cedar (*Juniperus*).

Leptura canadensis *Fabr.*—Breeds in the trunk of hemlock (*Tsuga Canadensis*).

Ipochus fasciatus *Lec.*—Lives in the wood of sumac (*Rhus integrifolia* and *laurina*). *I. pubescens* Casey, has similar habits.

Monilema.—The species of this genus are said to feed on various species of prickly pear, and the larvæ probably live in the wood and roots of these plants.

Cyrtinus pygmæus *Hald.*—Has been bred from locust (*Robinia pseudacacia*), also beaten from hickory.

Psenocerus supernotatus *Say.*—Lives in the wood of dog-wood (*Cornus*), apple, and in the stems of the currant.

Monohammus.—The larvæ of this genus bore in the solid wood and in large branches of pine, fir (*Abies*), and probably other coniferous trees.

Dorcaschema nigrum *Say.*—Breeds in dead limbs of hickory.

Dorcaschema alternatum *Say.*—Found in mulberry and osage orange. *D. wildii* is also found on these trees, and their larvæ probably live in the roots or trunks.

Hetœmis cinerea *Oliv.*—Has been taken on mulberry (*Morus rubra*), and probably lives in the wood of this tree.

Cacoplia pullata *Hald.*—Beaten from oak by Mr. Joutel.

Goes tigrina *De G.*—Bores in the solid wood of hickory, oak and walnut, but seems to prefer white oak.

Goes pulchra *Hald.*—Bores in various species of hickory.

Goes pulverulenta *Hald.*—Breeds in the branches of beech (*Fagus ferrugineus*) and hornbeam (*Carpinus*).

Goes oculata *Lec.*—Found on hickory also *G. debilis*, which also breeds in oak branches.

Goes tessellata *Hald.*—Breeds in oak.

Plectodera scalator *Fabr.*—Bores in the roots of cottonwood (*Populus*) and willow.

Acanthoderes 4-gibbus *Say.*—Breeds in the twigs of hickory, oak, beech and hackberry (*Celtis*).

Acanthoderes decipiens *Hald.*—Bores in twigs of hickory.

Acanthoderes morrisii *Uhler.*—Lives in twigs of the tulip-tree.

Leptostylus aculiferus *Say.*—Breeds under bark of sweet-gum (*Liquidambar*), oak and apple; also reported as boring in osage orange.

Leptostylus biustus *Lec.*—Lives in dead branches of orange in Florida. Breeds in hickory twigs (Joutel).

Leptostylus commixtus *Hald.*—Breeds in the wood of locust.

Leptostylus macula *Say.*—Lives in the twigs and under bark of chestnut, oak, hickory, walnut, apple and butternut.

Liopus variegatus *Hald.*—Has been bred from dead chestnut branches.

Liopus fascicularis *Harr.*—Bores in dead wood of prickly-ash (*Xanthoxylus*) and locust.

Liopus cinereus *Lec.*—Has been bred from twigs of locust and hickory.

Liopus crassulus *Lec.*—Bores in dead twigs of hackberry (*Celtis*) in Texas.

Liopus alpha *Say.*—Breeds in the twigs of sumac (*Rhus glabra*) and apple.

Dectes spinosus *Say.*—Has been bred from the stems of the great ragweed (*Ambrosia trifida*).

Lepturges querci *Fitch.*—Breeds in the twigs of hickory, also beaten from oak.

Lepturgus fascetus *Say.*—Bred from apple branches by Mr. Joutel.

Lepturges symmetricus *Hald.*—Bred from chestnut branches by Mr. Joutel.

Hyperplatys aspersus *Say.*—Lives in dry twigs of poplar (cottonwood), hickory and has also been beaten from chestnut.

Hyperplatys maculatus *Hald.*—Lives in dead parts of the orange in Florida; also breeds in dry twigs of apple, hickory and poplar.

Urographis fasciatus *De G.*—Lives under the bark of oak, maple and hickory; bred from apple and pear by Mr. Joutel; also beaten from limbs of chestnut.

Urographis triangularis *Hald.*—Bores under the bark of hackberry (*Celtis*).

Acanthocinus nodosus *Fabr.* and **A. obsoletus** *Oliv.*—The larvæ of both these species live under the bark of pine. The latter species also breeds in hickory.

Hoplosia nubila *Lec.*—Larva bores in dry beech and basswood twigs.

Pogonocherus mixtus *Hald.*—Bores in the branches of willow.

Ecyrus dasycerus *Say.*—Larva bores in the twigs of hickory and locust.

Eupogonius vestitus *Say.*—Bred from hickory and beaten from chestnut.

Eupogonius tomentosus *Hald.*—Larva mines the branches of the pine.

Oncideres cingulata *Say.*—Lives in the twigs of hickory, persimmon, oak, cherry, apple, pear, orange, and said to also affect other trees.

Oncideres putator *Thom.*—Larva lives in the twigs of the mesquite in Arizona.

Ataxia crypta *Say.*—Bores in dry cotton stalks, and in dry twigs of hackberry (*Celtis*), box elder (*Negundo aceroides*), and oak.

Hippopsis lemniscata *Fabr.*—The full grown insect and larva has been found in the stalk of *Ambrosia*.

Saperda obliqua *Say.*—Bores in the trunk of the common alder.

Saperda calcarata *Say.*—Bores in the solid wood in the trunk of poplar and also said to live in linden.

Saperda candida *Fabr.*—Lives in the trunks of apple, pear, plum, quince, cherry, thorn, mountain-ash, and june-berry (*Amelanchier*).

Saperda fayi *Bland.*—Breeds in the branches of thorn (*Crataegus.*)

Saperda vestita *Oliv.*—Lives in the large branches and under bark of linden.

Saperda discoidea *Fabr.*—Breeds under the bark of hickory.

Saperda tridentata *Oliv.*—Larva lives under the bark of elm.

Saperda lateralis *Fabr.*—Lives under the bark of hickory.

Saperda mœsta *Lec.*—Lives in the smaller branches of poplar and willow.

Saperda concolor *Lec.*—Bores in young shoots of poplar and willow.

Saperda puncticollis *Say.*—Breeds in poison-ivy (*Rhus toxicodendron*).

Mecas inornata *Say.*—Bores in the roots and lower part of the stems of *Helenium tenuifolium*, also recorded as living in the shoots of willow and poplar.

Oberea bimaculata *Oliv.*—Burrows in the stems of blackberry and raspberry.

Oberea schaumii *Lec.*—Larva bores in the twigs of cottonwood (poplar).

Oberea mandarina *Fabr.*—Bores in the twigs of poplar.

Oberea quadricallosa *Lec.*—Lives in the stems of willow.

Tetraopes tetraophthalmus *Forst.*—The larva bores in the roots and lower parts of the stem of milkweed (*Asclepias*). The larvæ of the other species of the genus probably also live in a similar manner.

Dysphaga tenuipes *Hald.*—Breeds in dead limbs of hickory.

NOTE ON GEOGRAPHICAL DISTRIBUTION AND MIMICRY OF APATELA.

By A. RADCLIFFE GROTE, A. M.

The majority of the species of *Apatela* occur in North America, where their range is extraordinarily extended, since they are found from Hudson's Bay territory in the north to the tropical regions in Mexico; they appear to be absent from the West Indies. From North America, north of Mexico, sixty species are described, the European fauna has a total of fifteen (consult Grote, Die Verwandtschaft zwischen der Noctinden-Fauna von Nordamerika und Europa, Gerhandl. Gesell. Deutsch. Naturf. und Aerzte, Bremen, 1890). A surprising number of species have been collected in Bastrop Co., Texas, by Belfrage; from this State twelve species are recorded. From California only four species are certainly known, *perdita*, *spinea*, *lupini*, *felina*: the last is, according to Dr. Dyar, an *Acronycta*, the second and third I have referred to a distinct subgenus, *Merolonche*, but, after seeing the European *menyanthidis*, it appears possible to me that *spinea* is congeneric or, at least, related. The bulk of the species are found over the temperate regions of the South American Continent, from Lower Canada to the Gulf: from New

England to Colorado. According to the classification of the larvæ, five subgroups are common to Europe and North America. Strictly "representative" species, true species of replacement, seem to be only *alni* and *funeralis*, *cuphorbiæ* and *sperata*, *auricoma* and *impressa*, *leporina* and *vulpina*, while, although the moths are very near, the larvæ of *psi* (or *tridens*) differ rather decidedly from *occidentalis*, so that *psi tridens* and *occidentalis* appear rather as parallel species. The species referred to *Hybona* and *Triæna* are very numerous in North America, the larvæ being more or less easily distinguishable, while the moths differ chiefly in their relative proportions, the *psi* pattern being repeated in *morula*, *occidentalis*, *hasta*, *furcifera*, *betulæ*, *grisea*, *tritona*, *quadrata*, *lobeliæ*, *radcliffei*. Peculiarly European groups are offered by those named by me *Apatela*, *Cuspidia*, peculiarly American are *Megacronycta*, *Philorgyia*, *Tricholonche* and *Lepitoreuma*. Taking all the groups in the synopsis as distinct, we have eight American, three European and five common to both faunæ, from larval characters alone.

Although in North America the genus *Apatela* offers peculiar outgrowths, so to speak, its affinity with the European is decided. We may therefore regard it as one of the survivors of a former holoarctic or circumpolar fauna, which would have been forced southwards, both in America and Asia, by the advent of the Glacial epoch. Traces of this European affinity are found in the moths of Japan, and has then the same origin. To the same shifting of the faunal extension, the sundering of species once occupying an extended territory, through climatological changes, we must ascribe the fact that the genus *Oreta* is found in Japan and North America. If my suspicion that the California *spinea* and the European *menyanthidis* are related is verified, it would be another link in the chain of facts which go to show that the Rocky Mountains have proven a barrier to the extension of certain types to the eastward. Conversely the Citheroniidæ occur only in the East. We find in California a true *Saturnia* and true or typical *Hypena*, together with Arctian and other types having a strong European facies. It seems natural to suppose that these have taken a west coast direction in the glacial movement to the south, and there now maintain themselves. The occurrence in Maine and Canada, north of the Great Lakes, of species of *Pyrausta* and *Agrotis*, which we know from British Columbia or northern parts of California, may be explained not only on the general principle of a southward migration over the whole territory, but possibly by the fact that inter-communication between the West and East meets to the northward in certain places less difficult

barriers. There is also the dependency upon food plants and geognostical conditions to be considered. At any rate, the central California fauna must be studied from the point of view that it is isolated upon a comparatively narrow strip of land as compared with the fauna east of the main range. And this view must be taken of the fauna of the West Coast, both in North and South America, wedged in as it is between the sea and the mountainous backbone of the New World.

The very near relation between the moths of *psi*, *tridens* and *occidentalis*, while the larvæ are so strikingly different, recalls the case of *Datana* and *Phalera*, though here the larval characters are decidedly stronger and even structural. We may assume that here the tendency to split into distinct larval forms was early developed, and that it exemplifies the fact that specific characters in *Apatela* are best, perhaps first, expressed in the younger stages. The two European species seem altogether nearer, and lead to the impression that they have a more immediate connection, while the American probably left the common ancestor at the close of the Tertiary.

In 1894, Dr. Harrison G. Dyar discussed the appearance of the larvæ of *Apatela*, and his remarks are in part applicable to the European forms. The diversity is mainly ascribed to a "mimicry of all sorts of objects, from that of resemblance to the foliage (*grisea*, *tritona*), to warning colors (*oblinita*) and mimicry of special objects, such as spider's nest (*vulpina*) or of some other specially defended larva (*radcliffei* mimics *Datana*, or *luteicoma*, which probably mimics *Orgyia*)." Previously, in 1893, Dr. Chapman had discussed the mimicry of the larvæ as follows: "The protection which the full grown larvæ have from their enemies, owing to their special form and coloring, is a matter that in its details, has very largely eluded me; I have, in fact, seen very few *Cuspidia* in the wild state. *Psi* and *tridens* are usually conspicuous; *strigosa* no doubt closely assimilates to a hawthorn leaf with a bit of brown dead leaf or twig. My observations on *leporina* were made and repeated a good many times on the green white-haired form occurring on alder; this larva sits somewhat curled round, near the middle of the underside of a leaf. Looking down from above it is absolutely hidden, looking up from beneath it ought to be very evident, but this is far from being the case. I have several times missed a larva till I have looked three or four times, and have also fancied I saw a larva when none was there. In looking up from below through the foliage of an alder tree, most of the lower leaves are in the shade of the upper ones, but here and there a gleam of light falls through on to a

portion of a leaf, and gives it quite a different tone and appearance, as seen from beneath. A larva of *leporina* seated beneath an unilluminated leaf, precisely resembles one of these patches." It is the American representative of *leporina*, my *vulpina*, which Dyar fancies bears, in its position on the leaf, a resemblance to a spider's web. I have at one time fancied that the larva of *alni* and *funaralis*, had deterrent colors, but conclude that it is a case of mimicry. The black body resembles a wet twig, the creamy dorsal patches mould, while the spatulate hairs are like the filaments of club mosses. The somewhat slow and stealthy movement which I have noticed in this to me repulsive larva, adds to the deceptive likeness to these inanimate objects so common in the woods. The young larva of *alni*, resting in a curled position on the leaf above, seems to imitate in its colors bird excrement.

With regard to the mimicry of caterpillars we must remember that larvæ are exposed to the attacks both of vertebrates and invertebrates. Birds prey upon them, and they have every reason to fear the attacks of insect parasites. The law of vision may thus be assumed to be the same for the vertebrate as for the insect eye. Both the bird and the wasp must be deceived by the appearance of *alni* and of *funeralis*, and pass them over, if the mimicry is to be effective. It may be argued, from the unity in the manifestation of mimicry, no general indications being apparently offered, of mimicry working in two directions to meet different visual conditions in its enemies, that it succeeds both with the bird and the wasp in a percentage of instances. The original percentage, like the original variation was small, but sufficient to establish the original direction, and, once established, it is evidently worked out by heredity to the condition in which we now find it. To be effective with the wasp, as with the bird, the mimicry of *alni* must produce a similar effect upon the retina of both; in this case not only the form, but the color, must be seen, both together suggesting to the brain of bird and insect not the real, but a different, and, to them, indifferent object. The immunity is probably only the result of cursory examination, but even this is sufficient to justify the variation. So far as the larval groups in *Apatela* are established, they partly show a special direction in the means to secure immunity from their enemies. Thus the more typical forms of the subgenus *Hyboma* resemble foliage, while several species belonging to the genus *Pharetra* seem deterrent. The general neutral gray tint of the moths has been commented upon by authors as adapted to conceal them from observation in their usual resting places, in the crevices of the bark and against the trunks of trees. The moths which choose such resting

places in the daytime have generally gray or blackish, protectively colored primaries, of such neutral tints as to deceive the eye in passing rapidly over an extended surface. But in *Apatela* the direction of the mimicry, the object copied, differs in the larva and moth of the same species. The independent direction of the larval efforts in this respect is important evidence in sustaining the view that in metamorphosis the stages acquire characters useless to the succeeding, and that here the larva of *Apatela* has attained an independent perfection as regards ultimate peculiarities of adaptive structure applicable only to the conditions of its own particular stage.

CORRECTION OF THE TYPE OF AGRONOMA AND NOTE ON LASPEYRIA.

By A. RADCLIFFE GROTE, A. M.

It has been recently stated by Mr. John B. Smith that the type of *Agronoma*, given by me in the Bremen List, May, 1895, p. 23, viz: *vestigialis*, does not correspond in structure with *jaculifera*, the type of *Feltia*, inasmuch as the front is not roughened or tuberculate and the front pair of tibiæ are not heavily armed. Still my reference of *Feltia* to *Agronoma* will hold. The material examined by me in Bremen in 1893–4, when writing the list, is no longer accessible to me and I am not sure what species I examined. But Hübner's genus *Agronoma* contains, beside *vestigialis*, both *crassa* and *exclamationis*. I have examined here, in the Roemer Museum, specimen of *crassa*. The fore tibiæ are heavily armed, the front is roughened or tuberculate, the male antennæ are pectinate. It is therefore a *Feltia*. Inasmuch as *vestigialis* is referred as belonging to *Agrotis* in a restricted sense, and as congeneric with the type *segetum*, as established by me and adopted by me in the "Revision," it follows that the type of *Agronoma* must be changed and *crassa*, the first species cited, is then the type. Hübner establishes *Agronoma* for species having the general aspect of *jaculifera*; the claviform is usually suffused with a darker color. Probably the European species *exclamationis*, *cortica*, *obesa*, *graslini* and *fatidica* belong to *Agronoma* and share the structure of *crassa*. The name of our common North American species will then remain, as claimed by me in the list: *Agrotis* (*Agronoma*) *jaculifera* Gn. Those using my Bremen List will please make the correction and I am much

obliged to Mr. Smith for this opportunity of showing its necessity. As soon as possible I hope to bring the European and American species into more complete accord. Up to the present I have had insufficient material and opportunity.

I have lately had the opportunity of examining the Sectio I of Germar's Prodromus, 1811. In this the author establishes the genus *Laspeyria* for *flexula*. Duponchel's genus *Aventia*, 1841, has been in general use for this species, but it must apparently now yield to Germar's earlier term. We would now have the species of Schrank's genus *Drepana* finally properly referred. To me, at least, this is a matter of satisfaction, as I have occupied myself with the group at various intervals since 1862. Of these genera *Cilix*, *Platypteryx* and *Laspeyria* are confined to Europe, *Drepana* and *Falcaria* are common to Europe and North America. *Oreta* to Eastern Asia and North America. *Laspeyria* must be removed from the family Platypterygidæ and referred to the Agrotidæ, subfamily Hypeninæ.

NOTE ON ENÆMIA CRASSINERVELLA *Zell* (MIEZA IGNINIX *Walk.*).

By Annie Trumbull Slosson.

Walking one day in February along the shore at Punta Gorda, Florida, I saw a small larva upon my sleeve. It seemed to have spun down by a thread, and, looking up, I saw many similar larvæ suspended from leaves and branches of a shrub. This shrub was one quite common along the west coast. It has sharp and stout thorns and small, rather coriaceous leaves of dark green. I have never seen it in flower or fruit, and do not know its name.

I carried home some of the larvæ with the food plant. From their general appearance I thought them Limacodids. They fed well in confinement, throve and grew. At the end of a week or two, as I was leaving Punta Gorda, and feared I might not be able to procure proper food on the east coast, I liberated many of my captives, and, believing in the survival of the fittest, retained only the largest and healthiest. The limited supply of food proved sufficient, and I brought several larvæ to maturity. Soon after I reached Palm Beach these spun curious little cocoons, very Limacodid-like in appearance, and of the same tough

parchment texture. In the meantime I had sent to Dr. H. G. Dyar some of the larvæ for examination and identification. He wrote me that they were evidently highly specialized Tineids and of much interest, and expressed his hope that I would raise the moth. In a little less than four weeks from the time the cocoons were made the moths appeared. I at once recognized them as *Mieza igninix* Walk., the *Enœmia crassinervella* of Smith's check-list. This dainty little creature, with primaries of silvery white, striped and dotted with black and secondaries of vivid rose color, is not uncommon at Punta Gorda, and I had taken it several times this season resting on leaves near the spot where I found the larvæ. Dr. Dyar will publish a full description of the larva, with notes.

A DESCRIPTION OF THE LARVA FOUND BY MRS. SLOSSON.

By HARRISON G. DYAR, PH. D.

Considerable interest attaches to Mrs. Slosson's discovery of the larva of *Enœmia crassinervella*, since in it we find an exposed feeding Tineid. These are always of interest, for as soon as the Tineids abandon their concealed mode of life numerous specializations occur, and usually in the direction of some higher family of the group—the superfamily Tineides. I was able recently to describe a Tineid (*Butalis basilaris* Zell), which had assumed many characters of the Pterophoridæ, and now I shall describe the present species with strong tendencies toward the Eucleidæ, yet without losing its essential Tineid characters.

Larva.—Flattened, thick, head partially retractile, but large, joint 1 2 slightly enlarged dorsally; shape of Harrisina, but more flexible, suggesting the Eucleidæ by the soft, subventral region; feet very soft, short, of the normal number. Setæ single, except a few irregularly distributed secondary setæ, or rather reduplications of the primary ones, short, stiff, glandular tipped. Setæ i and ii approximate, in line transversely, a secondary seta adjacent to i or ii or both, irregular in position. Seta iii single; iv and v approximate, yet by no means consolidated; iv a little above v, with or without a secondary seta below and behind it; vi double; two setae on the leg. Joints 3 and 4 with both primary and sub-primary setæ, a secondary seta near i a and i b and near ii a and ii b on joint 4, but variable. Seta iii seems absent on joint 4, though present on 3. Cervical shield large, black, with six

setæ, normal. Spiracles large, circular, Eucleid-like, a soft, eversible, colorless space above tubercle vi on the segments with feet.

Head black, the sutures pale; labrum white. Body with the dorsum broadly black, containing a narrow white dorsal line, a broader pale orange addorsal line, darker orange at the slightly elevated tubercles i and ii, especially on joints 3, 12 and 13; a narrow white subdorsal line. Lateral region colorless; a broad white lateral line above tubercle iii, edging the black dorsum; a narrow white stigmatal and a subventral line. Spiracles yellowish; setæ pale. Anal plate whitish, slightly marked with black. Skin finely transparent granular, the markings appearing as if below the surface, as is so common in the Eucleidæ. Hooks of the abdominal feet in a half circle on the inner side of the planta. Length of the larva 8 to 9 mm. Width of head about 1.3 mm.

Cocoon.—Rounded, flattened on two sides by the leaves between which it was spun, of a firm hard texture like the cocoon of the Eucleidæ and of the same dark brown color. There is, however, no lid for the emergence of the moth, but the pupa forced a crack along one side where the cocoon was angulated by the leaf and emerged entirely on the escape of the moth. The pupa is simply a soft transparent yellowish skin without cremaster, possessing the usual Tineid characters.

NEW CALIFORNIAN SPIDERS.

BY NATHAN BANKS.

Most of the following new species of spiders were contained in a collection sent me for determination by Prof. V. L. Kellogg, of Leland Stanford Junior University.

THERAPHOSIDÆ.

Atypoides californica, sp. nov.

Length ceph. 5.5 mm., breadth, 4 mm; abdomen long 6 mm. The cephalothorax is pale, head fusco-olivaceous, mandibles still darker, legs and sternum pale, abdomen brownish, venter lighter. Eyes similar to *A. riversi*, but the cephalothorax plainly broader than in that species; the groove simply a round impression, not elongate; legs shorter and more spiny than in *A. riversi*, there being a few spines on anterior tarsi, smooth spaces above on the patellæ; second joint of palpi almost as long as the anterior femora; six spinnerets, the small pair thicker than in *A. riversi*, superior pair shorter than in that species, the last joint not longer than the penultimate, and conical in shape.

Black Mt., Calif., Oct. 23, trap-door alongside of creek. Mr. R. W. Doane, collector.

DRASSIDÆ.

Pœcilochroa pacifica, sp. nov.

Length 7 mm. Cephalothorax and legs reddish, latter darker toward tips; mandibles red brown; sternum reddish; abdomen black, with a broad white stripe on each side above, reaching from base to beyond middle, connected at middle; some indistinct pale chevrons above the black spinnerets; venter black, with a large basal area pale. Much resembling, at first sight, *P. variegata*, but different pattern on abdomen, and pale anterior legs and mandibles; the dorsal groove longer and more distinct; the posterior row of eyes straight, or barely recurved, the P. M. E. more than once their diameter apart; the sternum broader. The epigynum shows a nearly circular dark area, with a narrow transverse cavity in its posterior part.

Univ. Campus; Nov. [R. W. Doane].

AGALENIDÆ.

Agalena pacifica, sp. nov.

Length 8-12 mm. Cephalothorax pale yellowish, seam black, a straight black stripe each side; mandibles rather reddish; sternum reddish or yellowish; legs yellowish, often with rather indistinct dark bands; abdomen pale, with a black stripe each side above, a curved line partly around the spinnerets, and a line on each side of venter, black; epigynum reddish. P. M. E. about their diameter apart, farther from the P. S. E.; A. M. E. hardly one-half their diameter apart, and as close to the A. S. E.; last joint of the superior spinnerets no longer than the penultimate. The epigynum consists of a large rounded cavity, broader than long, opening behind into a cavity that extends to the transverse groove. The male palpi are black, the tibia much longer than broad, rather curved on the outer side, and has at base a double projection, each branch with a rounded tip, and at its tip, on the under side, a short straight projection; the tarsus is not prolonged much beyond the bulb, there is a short curved tube at tip of bulb, a curved plate on inner side toward base, and some short pieces near the center.

Palo Alto and Black Mt.; Oct. and Nov. [R. W. Doane.].

Agalena californica, sp. nov.

Length 7–10 mm. Cephalothorax pale yellow, with a black seam, and a straight black stripe each side; mandibles more reddish; sternum pale in middle, always dark on sides; legs pale, darker toward tip, and with many black bands; abdomen thickly spotted with black, forming a stripe each side, two curved pale marks at base, followed by pale spots; venter with a black line each side, and black spots on middle. Eyes similar to *A. pacifica*; apical joint of superior spinnerets nearly twice as long as penultimate; epigynum shows a cavity much broader than long, and the anterior margin at middle projecting backward. The tibia of the male palpus is about as long as broad, with a concave hard piece on the outer side, the basal ridge of which

is rather prominent; at the tip on the under side is a curved projection; on the inner side of bulb is a long pointed piece, and near the tip is a short, stout tube.

Palo Alto and Black Mt., Oct. and Nov. [R. W. Doane].

Tegenaria californica, sp. nov.

Length 3.5 to 4 mm. Cephalothorax pale, with a black margin, dark spots on the radial furrows, a larger one over the dorsal groove, which gives off branches, the narrower pair curve to the P. S. E., the broader pair extend to the P. M. E.; eyes on black spots; mandibles testaceous, sternum blackish; abdomen black, with white spots, mostly near base, and some narrow chevrons near tip; venter spotted, the spinnerets black; legs pale, four marks on underside of femora, one on patellæ, three on tibiæ, two or three on metatarsi. Cephalothorax low, moderately broad; anterior row of eyes straight, A. M. E. smaller than others, hardly one-half their diameter apart, posterior row procurved, the P. M. E. fully their diameter apart, and as far from the equal P. S. E.; sternum broad, pointed between hind coxæ, sides rounded; legs long, with scattered slender spines and hairs; abdomen nearly twice as long as broad, pointed behind. The epigynum shows two oblong dark marks, reddish and separated at base, black and united at tip. The tibia of the male palpus has a furrow at base, with a ridge each side, and a small projection at tip; tarsus very large, almost globose, with a slender tip, half as long as the main part, the bulb is circular, not much convex, with a stout, short, curved tube from centre, and a hyaline sheath.

Black Mt. and Univ. Campus; under boards, etc., Nov. [R. W. Doane].

EPEIRIDÆ.

Epeira excelsa, sp. nov.

Length ♀ 7 mm.; abdomen 5 mm. wide at base. Cephalothorax and legs pale yellow or brownish-yellow, usually without markings except bands at tips of metatarsi and hind tibiæ; sternum brown; abdomen brown or yellowish, a pale yellow band connecting the two basal humps, beyond sometimes with two blackish spots; venter dark in middle, with an indistinct yellowish mark each side. A. M. E. twice their diameter apart, P. M. E., fully once their diameter apart, scarcely larger than the A. M. E.; cephalothorax clothed with whitish hair; legs with many spines; sternum triangular, broader than long, abdomen broader than long, with a large conical hump each side above, rounded at tip. The epigynum has a short stout finger lying across a transverse area, the finger reaching but little beyond the furrow.

Palo Alto, Calif., May. [R. W. Doane].

Zilla californica, sp. nov.

Length ♀ 7 mm., ceph. 3.3 mm. long, 2.5 mm. broad, tibia I 3.5 mm The cephalothorax is whitish, marginal seam black, a large triangular black spot over the pars cephalica, somewhat ragged around dorsal groove, extending down on clypeus and on red-brown mandibles, sometimes showing darker middle and side-lines; sternum pale, broadly margined on the sides with black; legs pale, with black bands at middle and tip of femora, tip of patellæ, middle and tip of tibiæ, and less distinct beyond; abdomen grayish, with a broad folium, rather silvery near the middle, black

on edge and margined with silvery; sides finely striped with black; venter with a broad black stripe, narrowed toward tip, then widened to surround the dark spinnerets. A. M. E. more than their diameter apart, P. M. E. about their diameter apart, much farther from the S. E.; first pair of legs much the longest, three spines above on femur IV; abdomen elliptical; the epigynum shows a dark transverse area, three times as wide as long, and behind with a small projection from the middle.

Palo Alto, Calif.; Oct. and Nov. [R. W. Doane]; also Olympia, Wash.

Misumena californica, sp. nov.

Length 7 mm. Cephalothorax brownish, with a broad white middle stripe; mandibles white, brownish at base; sternum and legs pale yellowish; abdomen rather dirty whitish, with indistinct veinings and some black dots near center; venter pale, sometimes with a few black spots in middle. Cephalothorax as broad as long, equal to tibia I; P. M. E. a trifle further apart, but no larger than A. M. E.; legs thickly clothed with stiff bristles, four or five pairs of spines under tibia I, six or seven under metatarsus I; sternum not broad; abdomen broadest behind middle, quite high, pointed at tip; the epigynum shows a semi-circular cavity, divided by a narrow septum, and two holes behind.

Los Angeles, California, [A. Davidson].

Misumena pictilis, sp. nov.

Length 5 mm. Cephalothorax greenish yellow, black on anterior side margin, three black dots on each side in a straight row behind the P. S. E., eyes on white spots; mandibles greenish, each with a black point; legs greenish yellow, with some scattered black dots on the anterior pairs; sternum yellowish; abdomen greenish white, with a large reddish brown spot above, narrower in front, pointed behind, outlined by black dots and some others scattered in it, two large white spots near base and a series of double white spots behind; venter pale. Cephalothorax as broad as long, shorter than tibia I; P. M. E. barely further apart, and hardly larger than A. M. E.; legs slender, spines long, four pairs under tibia I, five or six under metatarsus I; sternum shield shaped; abdomen broadest behind the middle; the epigynum shows a rounded cavity, broader than long, divided by a rather broad septum, which is widened near the middle.

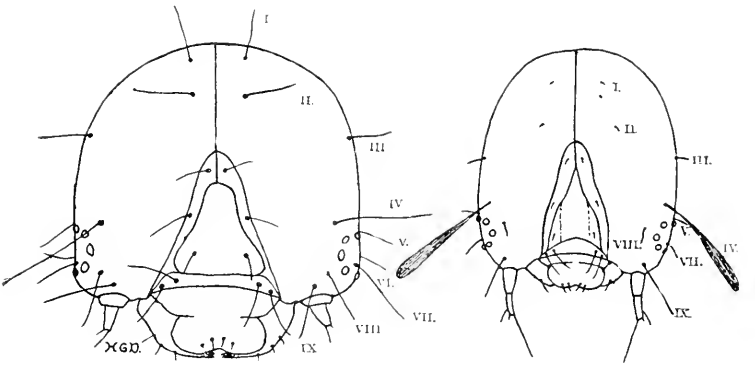
Palo Alto, California. [Stanford University Coll.].

NOTE ON THE HEAD SETÆ OF LEPIDOPTEROUS LARVÆ, WITH SPECIAL REFERENCE TO THE APPENDAGES OF PEROPHORA MELSHEIMERII.

BY HARRISON G. DYAR, PH. D.

The peculiar flattened antenna-like organs on the head of *Cicinnus melsheimerii* have long been known. Harris says: "On each side, just behind the five ocelli, are two flexible, slender, spathulate antennæ (?) which, however, seem to be without joints and incapable of motion." Again he says: "On each side of the middle of the head there is a black flexible kind of antenna, very slender where it joins the head and broader toward the end like the handle of a spoon." Dr. Packard remarks: "This larva is especially remarkable for new structures not known to exist in any other caterpillars, viz., a pair of long appendages, the use of which is quite unknown. They arise by a slender stalk behind and a little above the eyes, on each side of the head; the base is cylindrical, but the appendage soon becomes flattened or compressed and flattened bulbous at the end. The structures are brittle, not flexible, and they easily break off." From the foregoing it would appear that the homology of these structures has not been recognized, although it is a very simple one. The structure is an enlarged and flattened seta, exactly analogous to those on the body of *Apatela funeralis* and a few other larvæ. That one of the head setæ should assume this form is perhaps unique, but no more surprising than that some of the body setæ should do so. As to its function we are ignorant, as is also the case in regard to the *Apatela*, though we may surmise that in both cases it is to present a terrifying appearance toward small enemies. In *A. funeralis* these grotesque setæ certainly heighten the effect produced by the conspicuous larval coloration, and it may be that in *C. melsheimerii*, when the head is protruded from the case, these setæ on it have a similar deterrent effect.

Figure 1 represents the front view of the head of a larva belonging to the Noctuina (Agrotides). I have numbered the setæ on the epicranium from above downward. Setæ i and ii are near the median suture, iii in the central part of the lobe, iv above and before the fourth ocellus (numbered from below upward), v behind the fifth ocellus, vi behind the eyes as a whole on a level with the third ocellus, vii is



within the circle of the eyes above and behind the second ocellus, viii is before the second ocellus, and ix is above the base of the antenna. The clypeal setæ are shown, but not numbered. Figure 2 represents *C. melsheimerii.* It is evident at a glance that the spathulate seta or antenna-like appendage is the fourth epicranial seta. The head of *C. melsheimerii* is coarsely roughened with broad rounded pits. All the upper setæ (namely i and ii on epicranium and the three upper clypeal setæ) are greatly reduced, only tiny rudiments remaining. Seta iii is small but distinct, iv is enormously enlarged and flattened, situated above and behind the fourth ocellus. All the lower setæ are normally developed.

Cicinnus belongs to the *Microlepidoptera* (Tineides), and the exact position of its head setæ is in many respects more directly comparable with other Tineides. For example in *Plutella porrectella*, seta viii is situated before the fourth ocellus as in *Cicinnus* and not low down near seta ix as in the Noctuidous larva shown. However, I have preferred to figure the Noctuidous larva, as the comparison is thus given a wider scope.

DESIDERATA OF NORTH AMERICAN NOTODONTIDÆ.

BY A. S. PACKARD.

The following gaps or desiderata occur in our knowledge of the larvæ or the life-history of the North American Notodontidæ, and attention is drawn to them here in order that collectors and students may aid us in filling them up. It is particularly requested that the desired

eggs and larvæ may be sent to the author in order that colored drawings may be made of them for future publication in Part II. of the author's monograph of the Bombycine Moths of North America.

Three genera are still unknown, either in the egg, larval or pupal stage; these are *Ellida*, *Euhyparpax and Nystalea*.

Eggs and larva in all stages of
Gluphisia wrightii.
rupta.
albofascia.
formosa
lintneri.
Apatelodes angelica.
Datana californica.
floridana.
modesta.
Eggs and early larval stages of
Ichthyura apicalis.
inornata.
strigosa.
brucei.
Lophodonta basitriens.
Eggs and larva in all stages of
Drymonia georgica.
Lophopteryx elegans.
camelina.
Eggs and stages I and II of
Notodonta stragula.
Eggs and all the larval stages of
Notodonta simplaria.
Ellida caniplaga.
Dasylophia thyatiroides.

Eggs and larva of the two forms of
Symmerista albifrons.
Eggs and larva of
Symmerista packardii.
Eggs of **Hyparpax aurora.**
Eggs and all the larval stages of
Hyparpax perophoroides.
Hyparpax venus.
Euhyparpax rosea.
Eggs and larva in all stages of
Schizura apicalis.
Schizura perangulata.
Eggs and stages I, II, III, of
Seirodonta bilineata.
Heterocampa manteo.
Heterocampa astarte.
Eggs and all the larval stages of
Heterocampa chapmani.
Heterocampa plumosa.
Heterocampa hydromeli.
Heterocampa belfragei.
Heterocampa subrotata.
Cerura occidentalis.
Cerura occidentalis.
Cerura scolopendrina.
Nystalea indiana.

The pupa of each or any of these is desired, either alive, or in alcohol, or the cast shells. Eggs and larvæ of the following are also desired: *Platysamia ceanothi, gloveri, columbia; Hemileuca maia; juno, grotei*, and *yavapai*, (*Euleucophæus*) *tricolor, pamina; Coloradia pandora: Limacodes biguttata, rectilinea, y-inversa. Semyra beutenmulleri, Adoneta leucosigma* and *pygmæa, Heterogenea cæsonia, Tortricidia flavula, minuta* and *fasciola. Gloveria arizonensis Tolype velleda* and *laricis, Artace punctistriga.* A. S. Packard, Providence, R. I. Address during July and August, Merepoint, Cumberland Co., Maine.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF OCTOBER 1, 1895.

Held at the American Museum of Natural History.

In absence of the President, Mr. Dietz was chosen chairman *pro. tem.* Eight members present.

An invitation from the Brooklyn Entomological Society to attend their meeting and view the Neumoegen collection of Lepidoptera, was received and accepted with thanks. It was moved that a standing invitation be extended to the members of the Brooklyn Society to attend any of our meetings.

Mr. Shoemaker exhibited some Lepidoptera, among which was a specimen of *Limentis*, evidently a cross between *ursula* and *disippus*.

Mr. Joutel showed specimens of *Taxotes cylindricollis*, *Belamira scalaris*, *Leptura canadensis* var. *erythropus*, *Goes pulchra*, *G. pulverulentus*, *Saperda obliqua* and also *Leptura emarginata* which he found ovipositing in the branch of a white-oak tree.

Adjournment.

MEETING OF NOVEMBER 5, 1895.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Eleven members present.

The Treasurer's report was read and approved.

A communication from the Scientific Alliance stating that the expenses of the Alliance were estimated at $600, and that the share of the Society would be $30 (5%).

It was moved and seconded that the Treasurer be authorized to pay this sum.

The Committee on By-laws reported progress.

Mr. F. Küchler was proposed for active membership by Mr. Beutenmüller.

A paper entitled "On the Probable Origin, Development, and Diffusion of North American Species of Diabrotica by F. M. Webster," was read. (See Vol. III, page 158). Mr. Zabriskie exhibited *Microcentrum laurifolium* which he caught by imitating the call, with a quill, which was so perfect as to deceive the insect.

MEETING OF NOVEMBER 19, 1895.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Eleven members present.

Mr. F. Küchler was elected an active member.

Mr. Joutel gave some notes on the life history of the species of *Saperda* and *Goes*, illustrated by specimens of beetles and their work. Also some young larvæ of *S. obliqua* at work in alder. He mentioned that nine of the 13 species were found in New York City.

Mr. Beutenmüller and Schaeffer exhibited *S. cretata* and *S. moesta* from the west.

Rev. Zabriskie mentioned digging a *S. vestita* from apple, and read an article on the English way of setting butterflies.

Rev. Zabriskie also read a paper on the egg cones of *Chrysochus auratus* illustrated by beetles and cones.

Adjourment.

MEETING OF DECEMBER 3, 1895.

Held at the American Museum of Natural History.

President Rev. J. L. Zabriskie in the chair. Ten members present.

Mr. Ditmars read a paper entitled "Collecting at Delaware Water Gap."

Mr. Beutenmüller showed *Papilio homerus* from Jamaica and a pair of *Eudæmonia argus* from Africa which he said were worth £15.

Dr. Prime spoke on the book worm and mentioned that the head was so hard it was impossible to crush it with a knife blade. They seem to prefer old books.

Rev. Zabriskie showed the leaves of Hazel rolled into a ball by the weevil, *Attelabus rhois*. He said it was always the fourth leaf from the tip that the insect used to make its packet. It is found in early July.

Mr. Beutenmüller showed root of cherry tree perforated by larva of *Paranda brunnea*, also an elm branch attacked by *Hylesinus opaculus*.

Adjournment.

MEETING OF DECEMBER 17, 1895.

Held at the American Museum of Natural History.

President Rev. J. L. Zabriskie in the chair. Eleven members present.

Mr. Chas. Upson Clark was proposed as corresponding member.

The President appointed Messrs. Dietz, Groth, Beutenmüller and Dyar as a Committee on Nominations.

Mr. Dyar showed a rather rare series of plates colored by hand on the Bombycidæ. Mr. Joutel had examples of *Hexarthrum ulkei* and its ravages in a pine board. Also larvae.

MEETING OF JANUARY 7, 1896.

Held at the American Museum of Natural History.

In the absence of the President, Dr. R. Ottolengui was elected temporary chairman. Eight members present.

Treasurer report was read and accepted.

The following members were dropped from the roll: Mohns, Rix and Rosevelt. Mr. Charles Upson Clark was elected as corresponding member.

Mr. Herman Hug was proposed as active member by Dr. Kudlich.

The nominations for the year were:

President, Rev. J. L. Zabriskie; Vice-President, Charles Palm; Recording Secretary, Louis H. Joutel; Corresponding Secretary, R. L. Ditmars; Treasurer, C. F Groth.

Executive Committee: Messrs. J. L. Zabriskie, E. G. Love, Dietz, H. G. Dyar, C. F. Groth.

Publication Committee: E. Daecke, C. Schaeffer, L. H. Joutel, Wm. Beutenmüller.

Field Committee: L. T. Munch, Julius Meitzen.

On motion the Recording Secretary was directed to cast an affirmative ballot for these candidates, after which the officers were declared elected.

MEETING OF JANUARY 21, 1896.

Held at the American Museum of Natural History.

President Rev. J. L. Zabriskie in the chair. Fourteen members present, also Profs. Putnam and Sirrine.

Mr. Beutenmüller read a paper entitled "The Sesiidæ inhabiting America, North of Mexico.*

Prof. Putnam gave a short account of the life history of the bumble bees.

Dr. Ottolengui exhibited 25 rare Lepidoptera, a number of which had not been named.

Adjournment.

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* Will be published in Bull. Am. Mus. Nat. Hist. Vol. VIII, 1896.

MEETING OF FEBRUARY 4, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Ten members present.

Mr. Beutenmüller gave some notes on *Catocala*. He stated that *C. californica* had been made a variety of Walker's *C. electilis*, but that *californica* was a good species and *electilis* a Mexican species allied to *junctura*. He further stated that *C. cassandra* was the same as *electilis*, a figure of which was published by Mr. Druce in Biologia Centrali-Americana Het. Vol. I, pl. xxxi, Pg. 8.

After discussion, adjournment.

MEETING OF FEBRUARY 18, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Eleven members present.

A paper by Mr. A. P. Morse "On the stridulating Organs of Orthoptera" was read (see ante p. 16).

Mr. Dyar gave some notes on Head Setæ of Lepidopterous Larvæ. He stated that the setæ did not show much variation in position in the different larvæ he had examined. In regard to the flattened appendages of *Perophora melsheimeri* he said that they were called antennæ by Harris, who afterwards modified his statement. Mr. Dyar, by aid of diagrams showed that they were flattened hairs and originated from the setæ and corresponded to the hairs of other larvæ in position. He also showed a larvæ of *Apatela funeralis* which, in the last stage has all its hairs flattened.

Dr. Seifert exhibited a work on the European hybrid Lepidoptera, illustrated by many colored plates.

Adjournment.

MEETING OF MARCH 3, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Twelve members present.

A communication from the New York Microscopical Society extending an invitation to participate in their annual exhibition was received and accepted with thanks.

Mr. Schaeffer read a paper on the Coleopterous genus *Nodonota*, in which he gave the characters by means of which the species could be separated from other allied genera. He also spoke about the species occurring in the vicinity of New York, illustrated by a series of specimens.

Mr. Joutel exhibited specimens of Hickory, showing the borings made by the hickory borer (*Cyllene pictus*).

After discussion, adjournment.

JOURNAL

OF THE

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Vol. IV. SEPTEMBER, 1896. No. 3.

THE NORTH AMERICAN SPECIES OF NEMOBIUS.

By Samuel H. Scudder.

The North American species of the Orthopteran genus *Nemobius* Serville are more numerous than has been supposed, notwithstanding that several species have been more than once described as distinct. Prof. L. Bruner, of Lincoln, Neb., has kindly sent me a considerable series from his collection; Mr. A. P. Morse, of Wellesley, Mass., has placed his collection, mainly from New England, in my hands; the collections of the Museum of Comparative Zoölogy and of Mr. S. Henshaw have been at hand; and these, with a few specimens from the National Museum, added to my own, form the basis of the following table and descriptions. Although Trinidad belongs zoölogically to South America, I have added one species found there. The number of known species is hereby doubled, and doubtless more await discovery.

I should add that "*Nemobius circumcinctus*" Scudd. (Proc. Bost. Soc. Nat. Hist., XII, 143) from Mexico is a *Prothacustes* and identical with the later described *P. mexicana* Sauss.; the species given by Provancher (Faune Ent. Can., II, 24) as "*Nemobius* (*Anaxipha*) *septentrionalis* Scudd." was named for him by me as *Anaxipha septentrionalis*, but it is identical with *Anaxipha exigua* (Say); it was formerly (Nat. Canad., VIII, 61) called by him *Nemobius exiguus*, as Say's species; an insect referred to as "*Nemobius marginata*" by Miss Murtfeldt (Ins. Life, V, 155) is probably an accidental error, as no such name has been given; "*Nemobius? pulicarius*" Walk. (Cat. Derm. Salt. Brit. Mus., I, 111), is an *Anaxipha*. This covers all the North American species referred to *Nemobius*, except those given below in the synonymy.

I have followed Saussure in employing the female alone (or almost alone) in constructing the following table, since the males of several of

the species are unknown to me. Only the more important synonymy is given.

Table to determine the N. A. species of Nemobius.

A¹. Ovipositor as long as or barely shorter than the hind femora, generally rigidly straight.

b¹. Tip of ovipositor unarmed; last joint of maxillary palpi very obliquely excised at apex.

c¹ Tegmina short; wings wanting; last joint of maxillary palpi bicolored, the oblique apical excision of lower margin beginning before the middle..... **distinguendus.**

c². Tegmina long; wings very long; last joint of maxillary palpi unicolored, the oblique apical excision of lower margin beginning beyond the middle ..... **ensifer.**

b². Tip of ovipositor serrate or dentate; last joint of maxillary palpi almost transversely excised at apex.

c¹. Ovipositor distinctly (at least a tenth) longer than hind femora.

d¹. Blackish; dark and light colors of tegmina of ♀ feebly contrasted longitudinally above (Northern)..... **fasciatus.**

d². Grayish; dark and light colors of tegmina of ♀ strongly contrasted longitudinally above as on sides (Southern)..... **canus.**

c². Ovipositor barely as long as, or slightly shorter than, hind femora.

d¹. Teeth of ovipositor blunt, little elevated; wings generally very long ..... **socius.**

d². Teeth of ovipositor sharp, well elevated, well separated; wings wanting.

e¹. Tegmina of ♀ nearly or quite twice as long as pronotum; of ♂ strongly rounded apically, feebly margined with pallid at sides of dorsal field only, if at all..... **utahensis.**

e². Tegmina of ♀ scarcely longer than pronotum; of ♂ broadly rounded apically, with the dorsal field distinctly margined with pallid throughout except at base..... **ambitiosus.**

A². Ovipositor distinctly shorter than the hind femora, usually a little arcuate.

b¹. Tegmina of ♀ nearly or quite as long as the abdomen; wings generally twice as long as tegmina.

c¹. Ovipositor no longer, or scarcely longer, than head and pronotum together.

d¹. Face without vertical pale stripes; lateral field of ♀ tegmina tapering only on the apical third, subequal before it..**neomexicanus.**

d². Face with a pair of narrow, vertical, percurrent, pale stripes next the inner margin of the eyes; lateral field of ♀ tegmina regularly tapering almost from the base..... **trinitatis.**

c². Ovipositor distinctly longer than head and pronotum together.

d¹. Tegmina of ♀ apically truncate, a little shorter than the abdomen; wings wanting..... **aterrimus.**

d². Tegmina of ♀ apically rounded, as long as the abdomen; wings generally present and then very long..... **cubensis.**

b². Tegmina of ♀ much shorter than the abdomen; wings wanting.

c¹. Ovipositor barely arcuate.

d¹. Tegmina of ♀ no longer than head and pronotum combined. **mormonius.**

d². Tegmina of ♀ distinctly longer than head and pronotum combined.

e¹. Longitudinal markings of head continuous to extreme back of same; ovipositor with distinct and well separated teeth at apex. **toltecus.**

e². Longitudinal markings of head interrupted at the crown, the whole back portion immaculate, sharply defined from the portions in front at the summit, which is feebly subcarinate transversely; ovipositor with fine, close, minute denticulations.... **mexicanus.**

c². Ovipositor distinctly though but feebly arcuate..... **carolinus.**

Nemobius distinguendus, sp. nov.

Head not very full, castaneous black, with a straight, oblique, bright luteous stripe above the eyes, passing from the antennal scrobes to the back of the head on either side; eyes not prominent; antennæ blackish fuscous; maxillary palpi pale, the last joint infuscated except at base, very obliquely excised apically, beneath, over more than the apical half. Pronotum black, feebly tinged with testaceous laterally, rather closely hirsute with rather short fulvous bristles, equal, nearly twice as broad as long. Tegmina covering two-thirds of the abdomen, apically well rounded, uniform testaceous, but with the lateral field feebly infuscated; wings aborted. Legs blackish above, dull flavous beneath like the under surface of the body. Cerci very regularly tapering to a fine point, about as long as the pronotum and tegmina combined. Ovipositor fully as long as the hind femora, straight, slender, the apical blades scarcely enlarged at the base, regularly tapering, scarcely more than twice as long as their basal breadth, wholly unarmed, the tip acute. Length of body, 10 mm.; of hind femora, 6.9 mm.; of ovipositor, 7 mm.

1 ♀. Orizaba, Mexico (L. Bruner).

Nemobius ensifer, sp. nov.

Head rather full, blackish castaneous, faintly striate with testaceous posteriorly, lutescent down the face; eyes not very large, rather full and prominent; antennæ testaceous, somewhat infuscated beyond the basal portions; maxillary palpi luteo-testaceous, the last joint very obliquely excised apically beneath for a little less than half its length. Pronotum fusco-castaneous, sparsely hirsute with black bristles of no great length, equal, about half as broad again as long. Tegmina three-fourths as long as the abdomen, the tip very strongly rounded, subacuminate, the veins blackish or fuscous, the ground fusco-castaneous, more or less clouded; wings very long. Legs dirty luteous marked above with fuscous. Ovipositor considerably longer than the hind femora, very slender, a little arcuate, the apical blades rather long, scarcely enlarged basally, subequal in basal half, tapering beyond, wholly unarmed, the tip blunt. Length of body, 10 mm.; of hind femora, 7.75 mm.; of ovipositor, 8.25 mm.

1 ♀. Central America, Rev. Th. Heyde (L. Bruner).

This species and the preceding can be confounded with none of the others from the unarmed blades of the ovipositor. The males are unknown.

Nemobius fasciatus.

Gryllus fasciatus DE GEER! Mém. III, 522, pl. 43, fig. 5 (1773).

Nemobius fasciatus SCUDDER! Bost. Journ. Nat. Hist. VII, 430 (1862); GLOVER, Ill. N. A. Ent. Orth. pl. 6, fig. 13 (1872); SAUSSURE, Miss. Scient. Mex. Rech. Zool. VI, 389 (1874); STAL! Rec. Orth. III, 1 (1875); SAUSSURE, Mel. Orth. II, 242 (1877); BEUTENMULLER, Bull. Amer. Mus. Nat. Hist. VI, 266, pl. 5, fig. 9 (1894).

Acheta hospes FABRICIUS, Syst. Ent. 281 (1775).

Acheta servilis [Say, Mss.] HARRIS! Catal. Ins. Mass. 56 (1835).

Acheta (*Nemobius*) *vittata* HARRIS! Treat. 123 (1841).

Acheta vittata RATHVON, Rep. U. S. Dep. Agric. 1862, 380, pl. fig. 16 (1862).

Nemobius vittatus SCUDDER! Bost. Journ. Nat. Hist. VII, 430 (1862); GLOVER, Ill. N. A. Ent. Orth. pl. 3, figs. 9, 10 (1872); SAUSSURE, Miss. Scient. Mex. Rech. Zool. VI, 389 (1874); SCUDDER! Rep. Geol. N. H. I, 364, fig. 48 (1874).

Nemobius fasciatus vittatus BEUTENMULLER, Bull. Amer. Mus. Nat. Hist. VI, 267, pl. 5, fig. 10 (1894).

Nemobius exiguus SCUDDER! Bost. Journ. Nat. Hist. VII, 429 (1862).

? *Nemobius marginata* MURTFELDT, Ins. Life, V, 155 (1893).

This species is dimorphic: long-winged, with tegmina reaching commonly to the end of the abdomen (*fasciatus*); and apterous, with short tegmina (*vittatus*). To the former belongs *A. hospes* Fabr., and to the latter *A. servilis* Say and *N. exiguus* Scudd., this last not being *Acheta exigua* Say, which is an *Anaxipha*.

Both forms occur throughout the range of the insect, which is from Nova Scotia to North Carolina in the east, westward to the plains. I have seen specimens from as far north as northern New England, Montreal, Michigan, Minnesota and Manitoba, and as far west as South Dakota, Big Horn Mts. and Pine Cliffs, Wyo.; South Bend, West Point, Sydney and Lincoln, Neb.; Topeka, Shawnee and Barbour Cos., Kans. (all these western localities in Bruner's collection), as well as the Platte River, Nebr., and Iowa; and as far south as Decatur, Ala. (L. Bruner), and Virginia. It has been reported from other southern localities, which are probably correct, as Kentucky (Garman) and Mississippi (Ashmead); but of others I have some doubt, such as South Carolina, Louisiana and Texas (Scudder), East Florida (Walker) and Peru! (Bolivar), where probably other species are in question. In New England Mr. A. P. Morse has taken it on the top of Graylock, Mass.,

(3500'), but in the White Mountains, N. H., it occurs only in the valleys, so far as yet known.

Nemobius canus, sp. nov.

Head rather large and pretty full, beset with black bristles, gray from a mingling of dull fuscous and testaceous, above and posteriorly often separated into longitudinal stripes, the lower part of the face lutescent; eyes moderately prominent, subglobose; antennæ luteous, more or less, but nearly always slightly, infuscated; maxillary palpi luteous, the last joint infuscated, apically excised with a transverse obliquity. Pronotum subequal with slightly convex sides, generally less than half as broad again as long, sparsely beset with moderately long black bristles, luteo-testaceous, flecked more or less feebly, or suffused more or less generally with fuscous, especially mesially above and inferiorly on the sides, on the latter deepening to a fuscous stripe. Tegmina of ♂ hardly covering the abdomen, light testaceous often infumated toward base, laterally with an equal fuscous stripe next the dorsal area; of ♀ with an added fuscous longitudinal stripe on the dorsal face, outwardly, and either but little longer than half the abdomen and truncate (*brevis*), or nearly as long as the abdomen and well rounded (*amplus*); wings either wanting (*brevis*) or twice as long as the tegmina (*amplus*). Legs luteo-testaceous, the hind femora a little infuscated. Cerci fuscous, slender, scarcely longer than head and pronotum together. Ovipositor much longer than the hind femora, straight, the apical blades not enlarged at the base, regularly narrowing by the slope of the inferior margin, the tip acute, the upper edges serrate, the teeth not crowded. Length of body, ♂, 8.5 mm., ♀, 12 mm.; of hind femora, ♂, 7.5 mm., ♀, 8.6 mm.; of ovipositor, 9.5 mm.

6 ♂, 10 ♀. Dallas, Texas, (Boll); Texas, (Belfrage, Lincecum).

This species is closely allied to *N. fasciatus*, like which it appears in two forms, brachypterous and macropterous. It is possibly only a geographical race of that species, remarkable for its cinereous aspect and the striped appearance of the ♀ tegmina.

Nemobius socius.

Nemobius socius SCUDDER! Proc. Bost. Soc. Nat. Hist. XIX, 37 (1877).

This species was described from a single female from Georgia, in which the tegmina are almost as long as the abdomen, and the wings, if present, wholly concealed. It is the only such specimen I have seen. All the others, of whichever sex, have the wings very long. Additional specimens come from Sandford (Frazer) and Charlotte Harbor, Fla. (Mrs. A. T. Slosson), from New Orleans, La. (Akhurst, Schaum), and from Texas (Lincecum, "under stones" Belfrage, Bell, Aaron) the last from the Gulf Coast.

Nemobius utahensis, sp. nov.

Head not very full, dark fuscous mottled more or less with tawny, sometimes forming longitudinal streaks; eyes not very prominent; antennæ testaceous or cinereous; maxillary palpi dull testaceous, the apical joint, excepting the basal third,

blackish fuscous. Pronotum equal, much less than half as broad again as long, sparsely beset with black bristles of no great length, fuscous, with a more or less distinct, sometimes very distinct, testaceous, humeral stripe. Tegmina of ♂ shorter than the abdomen, very pale testaceous, strongly infumated at base, the lateral field with a piceous stripe; of ♀ covering a little more than half of the abdomen, very broadly rounded or subtruncate apically, testaceous with the lateral piceous stripe of the ♂ and a basal dorsal piceous spot. Legs fusco-testaceous. Ovipositor scarcely as long as the hind femora, straight or very faintly arcuate, the apical blades scarcely enlarged at the base, slender and tapering regularly to a fine point, with open serration. Length of body, ♂, 7.5 mm., ♀, 8 mm.; of hind femora, ♂, 6.6 mm., ♀, 6.25 mm.; of ovipositor 6 mm.

1 ♂, 2 ♀. Spring Lake, Utah, July (U. S. Nat. Mus.); Salt Lake Valley, Utah, Aug. 1–4; an immature ♀ was also taken at same date.

This is a smaller species than *N. fasciatus*, with relatively shorter ovipositor.

Nemobius ambitiosus.

Nemobius ambitiosus SCUDDER! Proc. Bost. Soc. Nat. Hist. XIX, 81 (1871).

This species is only known in brachypterous form and is probably never macropterous. It has been found only in Florida, at Ft. Reed (Comstock), Charlotte Harbor (Mrs. Slosson), Sandford (Frazer), Indian River (Priddy), and Jacksonville (Ashmead). The last two localities are derived from Bruner's collection.

Nemobius neomexicanus, sp. nov.

Head rather tumid, fuscous or fusco-castaneous, paler below; eyes rather small, not very prominent; antennæ dull luteous, maxillary palpi luteous, the last joint infuscated only at extreme tip. Pronotum tapering slightly forwards, less than half as broad again as long, sparingly beset with long black bristles, testaceous or fusco-testaceous. Tegmina of both sexes as long as the abdomen, infumated except along the sides of the dorsal surface and the costal margin, which are pallid, apically strongly rounded, the lateral field in the ♀ subequal basally, tapering only on the apical third; wings twice as long. Legs luteo-testaceous, the hind femora a little infuscated. Cerci slender, hardly so long as the pronotum and tegmina together. Ovipositor about as long as head and pronotum together, straight, the apical blades not basally enlarged, tapering regularly to a point, above sharply, rather strongly, and rather distantly denticulate. Length of body, ♂, 7 mm., ♀, 7.25 mm.; of hind femora, ♂, 4.5 mm., ♀, 5 mm.; of ovipositor, 3 mm.

2 ♂, 3 ♀. Las Cruces, N. Mex.; Los Angeles, Cal.; Sierra el Taste, Lower Cal.; Comondu, Lower Cal.; all through L. Bruner.

Nemobius trinitatis, sp. nov

Head rather tumid, fuscous; eyes hardly at all tumid; antennæ testaceous; maxillary palpi pallid, the last joint more or less infuscated apically, not more than half as long again as the penultimate joint. Pronotum scarcely tapering, about half

as broad again as long, more or less mottled with testaceous at the humeral angle. Tegmina as long as the abdomen, well rounded apically, fusco-fuliginous, more pallid along the union of the lateral and dorsal fields, the former in the ♀ tapering throughout; wings twice as long. Legs fusco testaceous or fuscous. Ovipositor about as long as the head and pronotum together, straight, not very slender, the apical blades a little enlarged basally, tapering regularly to a point, almost as long as the stem, bluntly, feebly and minutely serrulate. Length of body, ♂, 7.5 mm., ♀, 7 mm.; of hind femora, ♂, 6 mm., ♀, 5.5 mm.; of ovipositor, 2.6 mm.

1 ♂, 2 ♀. Trinidad (Uhler). This species must be nearly allied to *N. longipennis* Sauss., which I know only from description, but has a shorter and straighter ovipositor.

Nemobius aterrimus, sp. nov.

Head not very large, moderately full, black, more or less striped with castaneous above, posteriorly; eyes not very prominent; antennæ fusco-luteous; maxillary palpi fusco-luteous, the last joint infuscated except at base. Pronotum faintly tapering anteriorly, less than half as broad again as long, black, provided scantily with long, curved, black bristles. Tegmina black or blackish fuliginous, a little shorter than the abdomen, in the ♀ truncate apically; wings wanting. Legs dark fusco-testaceous. Ovipositor distinctly longer than head and pronotum together, but very much shorter than the hind femora, distinctly arcuate, the apical blades broadened basally, regularly tapering to a fine point, very minutely and closely serratulate. Length of body, ♂, 9 mm., ♀, 6.5 mm.; of hind femora, ♂, 6.25 mm., ♀, 5.5 mm.; of ovipositor 3 mm.

1 ♂, 1 ♀ Jacksonville, Fla.; Priddey, Ashmead (L. Bruner).

Nemobius cubensis.

Nemobius cubensis SAUSSURE, Miss. Scient. Mex. Rech. Zoöl. VI, 384 pl. 7, fig. 5 (1874); GUNDLACH, Ent. Cub. II, 367 (1891).

Nemobius volaticus SCUDDER! Proc. Bost. Soc. Nat. Hist. XIX, 36 (1877).

The doubtful reference by Bruner (Publ. Nebr. Acad. Sci., III, 32) to this species as coming from Nebraska is perhaps incorrect, but I do not know to what species the reference belongs.

There is some variation (at least in the United States) in the fineness of the serration of the blades of the ovipositor in this species. It is almost invariably long winged, but I have three females which are apparently apterous, though with long tegmina, one from Ogle Co., Ill. (Allen), the second from Chicago, Ill., the last from Florida. These first two localities are far north of any other known to me, excepting a single ♂ from Norway, Me. (Smith) in the Museum of Comparative Zoölogy (*possibly* wrongly labelled as to locality). Other specimens I have seen come from Georgia (Morrison), different places in Florida, such as Lake Worth and Charlotte Harbor (Mrs. Slosson), Sandford (Frazer), Capron (Comstock), and Indian River (Priddey–L. Bruner), Texas (Belfrage), Carrizo Springs, Tex. (Wadgymar–L. Bruner), Cuba

(Gundlach), San José del Cabo, Mex. (Cal. Acad. Sci., through L. Bruner) and Nicaragua (Shimek–L. Bruner). Saussure says it occurs in Cuba, Mexico and Brazil.

Nemobius mormonius, sp. nov.

Head flavo-testaceous, marked slightly with fuscous, not very full; antennæ flavous, inclining to testaceous, sometimes a little infuscated; maxillary palpi flavous, the last joint only about half as long again as the penultimate, its apical third infuscated. Pronotum flavous, much marked and blotched with fuscous, especially in the central portion of the disk and at the lower margin, equal, less than half as broad again as long, clothed sparsely with moderately long black hairs. Tegmina no longer than head and pronotum together, covering only half of the abdomen, apically truncate, black, with the veins, a humeral stripe, and both inner and costal margins pallid. Legs testaceous, more or less infuscated. Ovipositor much longer than head and pronotum together, much shorter than the hind femora, very feebly arcuate, slender, the apical blades distinctly enlarged at the base, long, tapering regularly and gently to a very fine point, delicately but not very closely serratulate. Length of body, 7 mm.; of hind femora, 4.75 mm.; of ovipositor, 3.5 mm.

2 ♀, and one nymph. St. George, Utah, April (E. Palmer).

Nemobius toltecus.

Nemobius toltecus SAUSSURE, Rev. Mag. Zool. 1859, 316; ID. Miss. Scient. Mex. Rech. Zool. VI, 386 (1874).

See the remarks under the next species.

The tegmina cover the abdomen in the ♂, but only about one-half of it in the ♀, and in both wings are wanting. Originally described from Mexico (Oaxaca is specified by Saussure in 1874), I have seen specimens only from the same country—Orizaba, Jalapa and Tepic, all through Prof. L. Bruner, the last from the collections of the California Academy of Sciences.

Nemobius mexicanus.

Nemobius mexicanus WALKER, Cat. Derm. Salt. Brit. Mus. I, 57 (1869).
Nemobius sp. BRUNER! N. A. Fauna, VII, 266 (1893).

It would seem impossible to determine Walker's species with any certainty without reference to his type. His description is about equally applicable to the present species, and to *N. toltecus*, but I have regarded this as more probably Walker's species from his description of the head, which cannot apply to *N. toltecus*, while Saussure's description seems to exclude the present species. The essential distinctions between the two are given in my table.

The ♂ tegmina cover the abdomen, but those of the ♀ are shorter and wings are wanting in both. It was originally described from Oaxaca, Mex.; Bruner's specimen, as quoted above, comes from Pana-

mint Valley, Cal. I have also seen specimens from Mexico (Sumichrast), near Mescico, Mex. (Palmer), and from Jalapa, Orizaba and Menanitlan, Mex. (L. Bruner).

Nemobius carolinus.

Nemobius carolinus SCUDDER! Proc. Bost. Soc. Nat. Hist. XIX, 36 (1877).
Cyrtoxiphus variegatus BRUNER! Publ. Nebr. Acad. Sc. III, 32 (1893).
Nemobius affinis BEUTENMULLER! Bull. Amer. Mus. Nat. Hist. VI, 249, 267, Pl. 5, fig. 11 (1894).

No macropterous form is known. There is considerable variation, apparently independent of locality, in the fineness of the denticulation of the blades of the ovipositor.

Specimens before me come from Jackman, Me. (Harvey—A. P. Morse), Norway, Me. (Smith—Mus. Comp. Zool.), Blue Hill, Milton, Mass. Sept. (S. Henshaw), Adams, Mass. (Morse), South Kent and Canaan, Conn., (Morse), New York (Beutenmuller), Ithaca, N. Y. (Morse), Orange, N. J., (Beutenmuller), Maryland (Uhler), Vigo Co., Ind. (Blatchley), District of Columbia and Virginia (Bruner), North Carolina (Morrison, Henshaw), Lake Worth, Fla. (Mrs. Slosson), Lake Okeechobee, Fla. Palmer), New Orleans, La , (Shufeldt—U. S. Nat. Mus.), Texas (Boll), Texas "Flying to light" (Belfrage), Lincoln, West Point and South Bend, Nebr. (Bruner).

IMPRESSIONS RECEIVED FROM A STUDY OF OUR NORTH AMERICAN RHOPALOCERA.

By HENRY SKINNER, M. D.

I wish to speak of specific values—a subject which has always agitated the scientific mind, and perhaps always will in the future. My excuse for writing on such a subject is the fact that I believe the proper kind of studies will enable us to approximate an absolute specific value, or at least get much nearer the truth than is now shown by a study of our catalogues and lists of species. I do not care to go into the trite subject as to what is a species, but think it only fair to give my own view, or that which I should follow in the rearrangement of our species. I look upon the species as the unit of classification, and therefore it is all important to have the basis of classification as scientifically accurate as possible. I would divide the definition of species into two heads:

First, the morphological, or groups of individuals more or less alike in appearance, form, structure or color; second, the physiological, or those forms of life capable of producing fertile offspring among themselves. A species based on the morphological part of our definition I hold to be purely tentative (as we must apply the physiological part of the definition before we can be absolutely sure we have a valid species, but unfortunately it is only seldom, or after the lapse of much time, that specific value is capable of such proof). Now, my idea is that instead of relying to too great an extent on morphological differences we could fix the value of those modifications by analogy or comparative value. That is, if I should say that certain species (and giving a list, say of 25) represent my idea of specific value, I think students would get a better idea of what I meant than if I should spill any amount of ink in definitions and controversies. On the other hand, I could give a list of so-called species that did not represent my idea of true specific value. I can give a better idea of my meaning on this subject when I come to compare the value of our species and when I refer to them as now listed. Our species were described by a number of authors, and therefore represent to a large extent many individual ideas. However, our last Catalogue (that of 1884, by Mr. W. H. Edwards) gives the list of species according to the best knowledge and belief of our foremost student of the diurnals.

I shall speak of the great variation in insects and say something of its causes, especially in the Lepidoptera. Some of our writers seem to have ignored absolutely the lessons these variations teach, especially when describing species. We have been so busy describing species and doing systematic work in this country that we have not had time to look into those interesting biological problems that have received so much attention abroad. There are many things which influence variation in the Lepidoptera which are more or less well known, but this knowledge has not been sufficiently applied in describing species, or perhaps in some cases has been ignored. The principal causes which bring about variation are different geological formations and soils; different foods; season; climatic conditions; horizontal and vertical distribution or what might be called longitude and latitude; altitude which produces apparently the same effect as vertical distribution. These causes may all be covered in a general way by calling them the effects produced by geographical distribution. Heat and cold may act locally at different times or is in other cases a factor in vertical distribution. "Succulent overgrown herbage produces large pale colored im-

agos, while dry semi-withered food produces dark imagos of small size. Heat accelerates the pupal stage and cold retards it and the effect is shown in the imagos. The character of the season influences the resulting imagos and also the number of broods. Sometimes species which are usually single brooded may in special season become double brooded, and those which are normally double brooded may produce an additional brood. The individuals of these different broods differ and in some cases to such an extent as to have been described as different species. Nearly, if not all, butterflies produced from wintering chrysalids are different in appearance from the subsequent summer brood or broods. *Pieris napi* and *rapæ* are whiter with the blackish markings nearly obsolete. *Papilio turnus* from wintering chrysalids in this locality look like the Arctic form. Species of *Lycæna* in their spring dress are very different from those produced later. Even what might be called anatomical differences are produced by season; thus in some of the Lycænidæ the spring brood is tailless, whilst the summer generation of the same insect is provided with these appendages.

In passing from the sub-tropical heat of the Rhone Valley through successive zones which are to be met with before reaching the perennial snows of the Gorner Grat and the peaks overhanging the Riffel, a collection of insects may be made which represents in temperature a difference of latitude as great as from Italy to Scandinavia. I am quite positive that if studies were made from large amounts of material from different localities the observing student would soon learn to tell from whence a given specimen of a species came, from its appearance alone. This is specially true of forms having a wide geographical range.

In *Anthocharis belia* by prolongation of the pupal stage we get var. *ausonia* which has the underwings (underside) white with yellowish green blotches, instead of being green with silvery spots. The spring brood of *Vanessa antiopa* has whitish wing borders instead of buff. In Holland a pale yellow border, and in Sweden, Norway and Lapland have white borders throughout the year. The same species from Pennsylvania can be distinguished from California examples, the latter being more nearly related to the European form. *Lycæna agestis*, a well known little brown butterfly, with a marginal row of rich orange spots, common in the south of England during May and August, when producing but a single annual brood, appears in July as a variety (*artaxerxes*) that presents the black spots on the wings replaced by white ones, and which was for a long time on that account regarded as a distinct species.

It has become an established fact that those color-bands with charming ocellated spots that so enhance butterfly kind, should everywhere vary, and in certain localities vanish; and many drab and brown wings fluttering among grass and shade, and from time to time have exhibited hillsman's spots that have caused a cry of new species, or prompted experts to enter on description where others see but variety. The large Heath Butterfly may be reckoned among these. This kind in the north of England at an elevation of two thousand feet, according to Mr. T. Marshall, and in some parts of Ireland, according to Mr. Birchall, has the eyes painted on its sandy wings greatly decreased in number; and on the Perthshire Mountains, conjointly with the English type, an aberration is sometimes seen even less ocellated, and this anomaly we find has established itself in Lapland as the local form *isis* of the species, the most boreal variation. Our species are said to be darker than the same or allied forms in Europe.

It has frequently been noticed that in the mountains of Europe, as well as in this country, that as we ascend the butterfly becomes smaller and darker and their sexes often lose the color differentiation. Woody coverts and proximity to the sea, as also the smoke of towns and manufacturing districts, are associated with variety and melanism. The system of variation in such localities is the same and the cause is constant, while external conditions of environment are multifarious. Thus the shades of New Forest afford a constant variety, *valesina* of *Argynnis paphia*, which instead of being fulvous is brown and spotted instead of streaked along the nervures; it will thus be noted that altitude produces much the same effect as shade." *Erebia blandina*, from Morecombe Bay, has the brown bands on the fore-wings replaced by yellow.

The Lepidoptera at Hastings and on the coast of Wales have been noticed as being often deviations from the types. On small islands butterflies have been considered to have enlarged wings, but it should then be noticed these islands lay far south in latitude, a consideration that might cause us to hesitate in accepting the premises on Darwin's explanatory theory that the larger wings are acquired from battling with the winds. "Species found in Japan have a much greater expanse than the individuals of the same species from Europe. Albinism is thought sometimes to be produced from light colored soils. Thus it is active on the English Chalk Downs, where it produces varieties in unstable genera of moths." The large Heath Butterfly is a very large insect (var. *typhon*) in Cumberland and Scotland on high hills; whilst

on low moss lands, on which water is charged with iodine, in Cumberland, Westmoreland and Lancashire, it is a rich fulvous brown insect, larger and stronger built; and when these are acted upon by hydrochloric acid gas they assume the exact color of the hill specimens. The dark Annulet moth (*Gnophos obscuraria*) on chalk lands is a light colored grey or drab insect. In carboniferous limestone districts it is a lead-colored insect, whilst on the New Red Sandstone formation it varies from a rich ochreous color where oxide of iron is present in the soil to a dark, almost black insect on the white sandstone parts of the New Red formation, thus clearly pointing to geologically caused changes of color. Any of these latter forms acted upon by chlorine appear as highly colored grays. The same remarks apply to *Dianthœcia carpophaga*. On chalk it is light buff; on "New Red" here, darker; but all buff in Cambrian at Llangollen; and at Penmaenbach darker still, buff or ochreous brown; and on quartoise early rock, rich dark cold grey-brown, as in the Isle of Man, and at the Howth, in Ireland, ochrey shades being rarely observable upon them; but, acted upon by hydrochloric acid gas they all turn to a beautiful bright light fawn buff, veritable *carpophaga* of the chalk.

It is to be observed, however, that some varieties we might be inclined to attribute to certain formations may be the result of a food proper to the soil. Thus in the cases of the Welsh Wave Moth (*Acidalia contiguaria*), bred continuously on heather from moss lands, all specimens become varieties, fumose specimens, whilst fed on succulent plants they are large light colored specimens, rarely darkish, but never so dark as when fed on heather from the moss. "We find seasonal varieties not alone alternating in ordinary years, but witness their production by fluctuations in annual temperatures. Thus while many butterflies produce one or two annual broods, in certain years, those ordinarily single brooded become double brooded; or those which are double brooded produce three annual generations."*

I now wish to apply some of these facts to our own Lepidoptera and wish to say in the beginning that want of exact localities and exact data on our specimens has been most pernicious and detrimental to all such studies. In many cases specimens are without localities or dates of capture or only have a State locality. Studies of variation produced by geographical variation in the broad sense indicated, or the effect produced by seasonal broods, are impossible without such data. I also wish

* I am indebted to Insect Variety, by A. H. Swinton, for these facts in relation to European Diurnals.

to condemn, in the most emphatic way, colored squares, silver or beautiful golden ones in the same way, and also numbers unless the absolute data and locality are also given. After many years lists which refer to numbers are lost, or the makers have not indicated on the lists what they mean, and many a time I have been driven frantic in looking over old collections. As a friend once said, God alone knows what they mean, and He won't tell. When I commenced my collection I was satisfied to have a single pair to represent the species, but now I cannot get enough individuals to represent all manner and kinds of variation brought about by natural causes. In the past I therefore knew this species or that, but now in many of our genera I nearly get brain fever in trying to determine where a species begins or ends.

In looking over our lists I would divide the species, so-called, into two classes, species and gradational or geographical forms. It should be remembered that most of our American entomologists were located in the Eastern part of the United States and were familiar with our Eastern species. When specimens were received from the West, more particularly the Pacific coast, it was of course seen that there was a difference between the Eastern and Western forms, especially where a few specimens were examined. This led to the description of new species (so-called), but there was a total ignorance of distribution, or what gradations or variations might be found between the extremes of localities. The same thing in a lesser degree occurs now. We are dependant upon specimens from localities where collectors accidentally happen to be, and our specimens (or species) show marked variations, in many cases due only to difference of locality. Nothing can be more pernicious than determining species from locality, yet some naturalists advocate this. The very fact that you determine a species by locality shows the whole weakness of such a procedure. What would be thought of a person who would describe a new species thus: Papilio humbugi differs from Papilio sp. by being found in Oregon, the latter flying in the vicinity of Philadelphia. This would be really better and indicate more than trying to describe minute geographical differences, and then really identifying the thing by difference in locality. I am positive that should some one go to work and hunt up the original descriptions of some of our species and find out the locality from whence came the types, and then get specimens representing the furthermost point of distribution and describe all these as new species, they would produce species of equal value to some of those already described and in our lists. It is perfectly legitimate to describe apparent new forms, but they should be

considered tentative only, and when the intervening gradational forms are found the true value of the new form should be recognized. The trouble with which we have to contend in such cases is that if we revise the work of others we are very apt to make them our enemies, and unpleasant controversies arise.

It has been said that there is no such species as *Papilio ajax* but the forms *walshii*, *abbotii*, *telamonides* and *marcellus*, which together make the species *ajax*. I do not object to this so long as the relationship is made apparent, but I would consider it entirely wrong to list these as distinct or specific names. The fault I find with our lists is that there is no exact comparative value among our so-called species. In one instance relationship may be thus indicated, and in other cases parallel value or relationship has not been so recognized.

I now propose to take a glance at our species and give some opinions as to their comparative value. I do not say that my ideas always represent exact facts, but I think they will incline toward the truth and indicate what lines of study may be taken up in this contention. I do not mean to be hypercritical toward the work of our American students, as their work equals that done in any part of the globe. Moreover I do not see how any one can suppose that the naming of a new species indicates the value for all time, as names are only tentative until proven absolute, as far as the doctrine of evolution will allow.

In our own country we have the wonderful effect of vertical distribution, seasonal changes, differences of soil, climate, food, geology and, in fact, everything which suggests itself in this connection. In the genus *Papilio* we have twenty-six named as entitled to specific rank. Of these twenty-six nine are of doubtful value in varying degrees and I would arrange them thus, *thoas*, *pergamus*, *hollandii*, *brucei*, *nezahualcoyotl*, *oregonia*, *nitra*, *rutulus*, *brevicauda*, those of least value being mentioned first and the rest following in order given. *Thoas* is a synonym of *cresphontes*, *pergamus* of *indra*. *Rutulus* is probably a horizontal race of *turnus*, and was described as such by its author Boisduval. I have a specimen of *Papilio* taken here (Philadelphia) that would pass as *rutulus*. I believe a sufficient number of specimens of *turnus* and *rutulus* representing geographical distribution would prove their identity. I may say right here that I believe the imago the culmination of nature's effort, and that while studies of transformation are most valuable they will not solve the problem of specific difference or identity. It would take too much space to go into details in regard to all these, and I will only give opinions in most instances. *Brevicauda*

would also have to be studied from the standpoint of distribution. *Nezahualcoyotl* is the *brevicauda* of *philenor*. Do some of these forms differ any more from their nearest allies than the extremes of the vertical distribution of *turnus*? Take, for instance, the Arctic form or the form from wintering chrysalids in this locality (Philadelphia). I have two females of *turnus*, one from Philadelphia and the other from Florida. One expands 3 inches and the other 6; the Florida example thus having a greater expanse of 3 inches. They differ as markedly in other ways, the Southern form being a rich orange and the local one almost white.

I have nothing to say about our species of *Parnassius*, except that I doubt that the true *nomion* has been taken in North America.

In *Pieris* we have ten species, and of these I consider three of doubtful value—*nelsoni*, *virginiensis* and *occidentalis*. The putting *virginensis* as a var. of *napi* and also as a species was probably the work of the printer's devil. Looking at the list and seeing var. *vernalis* of *protodice* reminds me of the fact that all butterflies to a greater or less extent differ in the spring or generation from wintering chrysalids, from those produced from eggs of the first, and if seen fit all should be called *vernalis*. Thus the spring generation of the Himalayan *Papilio polyctor* is called variety *vernalis*, and properly so, but the spring generation of *Pieris occidentalis* is called *calyce*. Would it not be better to call all spring variations the variety *vernalis* of the different species where the spring generation is different from subsequent broods. Some of the varietal names of species of *Pieris* are also synonymous of forms found in Europe. For instance, in Alaska we have var. *bryoniæ* of *napi*, of which I believe *hulda* is a synonym.

In *Anthocharis* we have fifteen species. Of these *flora*, *rosa*, *reakirtii*, *thoosa*, *stella*, *julia*, *hyantis* and *morrisonii* are of doubtful value. *Rosa* seems to be the same, or at best a var. of *olympia*. I should say it represented the southern end of the vertical distribution. *Reakirtii*, I believe, has been proven to be the *vernalis* of *sara*. *Thoosa* is probably the female of *cethura*. *Julia* and *stella* are slight modifications of var. *reakirtii*. *Flora* is a distribution modification of *sara*. *Hyantis* is probably a brood variation of *ausonides*. *Sara* and *reakirtii* both have interesting dimorphic females, one yellow, the other white.

In *Callidryas*, *sennæ* will probably be proven to be a synonym of *eubule*. In *Kricogonia* we have four species and a variety, and I believe them to be all one thing.

In the genus *Colias* much good could be done by obtaining collections from various localities, with proper data. We have in this

genus twenty species. Of these we have *harfordii*, *moina*, *alexandra*, *edwardsii*, *emilia*, of doubtful value. Now, in regard to *hecla*, *meadii* and *elis*, we know them from Greenland and Iceland, Laggan and Colorado, but do we know that they are not found over the intervening territory, and do we know that if they are thus found they would not show intergrades or evidences of the effect of vertical distribution? The Lapland *hecla* is quite different from the Greenland one, and shows as much difference as some of our so-called species. *Danais strigosa* is likely to prove a variety of *berenice*.

In the genus *Argynnis* we have fifty-eight species, of which about eighteen are of doubtful value. I have a large amount of specimens with proper data and the more I get the less I know in one direction (in relation to species as listed) and the more in regard to the real value of variation. The wonderful and interminable variation in this genus has already been pointed out. The presence or absence of silver spots below is in many species of no value whatever, and my studies would lead me to believe that an unsilvered form always has a silvered form, of regular or irregular appearance, except in a few such species as *alberta*, *astarte*. We may also have hybrids each year which occur annually, yet, of course, do not actually reproduce their kind. The difference produced by vertical and horizontal distribution is tremendous. Take, for instance, *cybele* from Maine and Florida, the difference is fifty-fold greater than between *aphrodite* from Maine and *aphrodite* from Colorado (*cipris*). *Aphrodite* from Maine and from the mountains of North Carolina are also wonderfully different in size and maculation and really differ to a greater extent than some of the gradational forms listed as species. I am studying this interesting genus and will now point out so-called species which show gradational forms or have been proven one and the same thing. I have found white females of *cybele* like unto *leto* and would refer reader to Ent. News, Vol. V, p. 318.

We want to know more about *nitocris*, but can't do anything until we get more material. *Cipris* is the form of *aphrodite* found in Colorado. *Alcestis* I have, showing every intergrade into *aphrodite*. *Electa* is so close to *atlantis* as to hardly warrant a varietal name and differs no more than other local forms of *atlantis*. The one found at Nepigon is not exactly like either. The forms clustering around *monticola* and *rhodope* are legion, hardly any two being alike. *Chitone* has hardly any two individuals alike and there are all grades of silver spots beneath—from nothing to a silver mine. *Inornata* is probably an unsilvered form of some of the other known species. *Artonis* (unsilvered) has been taken in coitu with (*eurynome*) silvered, both ways,

female *artonis* and male *eurynome*, and male *artonis* and female *eurynome*. This is also true (I think) of the *eurynome* found in Alberta, N. W. T., and the unsilvered *clio*. There is no doubt about these being all one species, and we may possibly add to them *opis* and *bischoffi*, the latter representing the upper end of the vertical chain, it being the dark arctic form which we would naturally expect. We need more information about *columbia*, *hippolyta*, *semiramis*, *liliana*, *laura*, *rupestris*, *macaria*, *egleis*, *bellona* and *epithore*. *Carpenterii* is the Alpine form of *cybele* and it is of interest to know that it has been produced in Colorado and Arizona by altitude and in British America by latitude. A friend has recently told me he was sure he had seen the form *alcestis* flying with *aphrodite* in North Carolina. Some of our smaller species are also gradational geographical forms, as, for instance, *montinus*, *boisduvalii* and *butleri* may also come in this category.

In regard to the *anicia* group of *Melitæa* I have the wisdom of Socrates, "I know that I know nothing; others know not even this." I have species, lots of them of value equal to those already described. *Wrightii* is the Southern form of *leanira*, and I have intergrades. Most of our specimens of *leanira* came from San Francisco and of *wrightii* from Los Angeles Co. Let us have the gradations from between. *Sterope*, *acastus*, *palla* and *whitneyii* are dangerously close. I should have said that *alma* is the desert form of *leanira*, and *fulvia* is very close to *alma*, if not the same. *Hoffmanni* I believe to be an aberration of *whitneyii*. *Perse* and *chara* are probably seasonal forms of one species. *Thekla* I take to be an aberration of *bollii*.

Phyciodes batesii needs investigation. I mistrust its specific value. *Camillus* is probably the central area form of *pratensis*. Mr. Edwards has established the identity of *Synchloë adjutrix* and *crocale* from the physiological standpoint (breeding). This had already been pointed out by Godman and Salvin from the morphological standpoint.

In *Grapta* the doubtful species are *hylas*, *rusticus* and *silvius*. *Silenus* looks like an occasional aberration. In the species of *Vanessa* and *Pyrameis* we have my idea of true species. *Junonia cœnia*, *genoveva* and *nigrita* are probably all one.

I have a large amount of material in *Apatura* and feel sure the species as listed will be reduced in number. I think the species of *Cœnonympha* as they now stand will be reduced at least one-half. Ocelli, spots and color are all of doubtful value as we now interpret them. My quotations from the English literature on the subject apply to our species also. I can see but one species in *Hipparchia ridingsii* and *dionysius*.

Satyrus needs study and revision, and I do not care to say much about them now, only that *ariane* has almost less than varietal value. Mr. Edwards has published a most interesting and instructive account of the species of *Chionobas* found in California, Oregon and Vancouver. He shows that these forms differ slightly and also shows that in the certain localities where they have been taken (where collectors are accidently found) the characters of the localities are different. He also says they are not found in the intervening territory. Now from my point of view I would not expect them to be the same if taken many miles apart, but would expect to find certain differences of less than specific value. The part of his argument which does not seem to me to be conclusive or proven is the alleged fact that the forms are not found in the intervening territory. I think they are probably found in places and that they would show the gradational, geographical, vertical, distributional differences seen in all Lepidoptera. I know this to be absolutely true of other species occurring in Oregon and Vancouver, and that they differ as much if not more than do *Chionobas californica* and *gigas*. This is true, for instance, of *Parnassius clodius*. Are we, therefore, to give one of these forms a new name? Of the *semidea* group I have nothing to say at present. *Libythea bachmani* and *carinenta* I believe to be one species, *larvata* probably being a variety of the latter form. *Carinenta* differs from its more northern representative in the same way as many other butterflies found North and South—for instance, like *Pamphila* var. *egeremet* and *otho*. *Lemonias mormo*, *duryi*, *cythera* and *virgulti* need investigation both geographically and in regard to seasonal broods. *Calephelis* species are open to some doubt. *Thecla* and *Lycæna* need study badly, also from the geographical and seasonal standpoints, especially the latter. All Lycænidæ should have on pin *exact date of capture* as well as exact locality. *Melinus* is a species of great variability and found all over the United States; it is the same thing whether from Maine, Vancouver, Florida or Arizona—the same tune but with variations. There are too many to mention, and I am sure there will be a certain amount of dropping in values.

In *Chrysophanus*, on a guess, I should say *arota* and *virginiensis* were perhaps seasonal differences and *xanthoides* and *dione* differ because the one is found in California and the other in Iowa. *Florus* would seem to be a variety of *helloides*, if it is not the *dorcas* of Kirby. The Greenland *hypophlœas* differs wonderfully from Pennsylvania specimens, and is more entitled to specific value than is *sirius*, the more Eastern *rubidus*. The one shows the vertical differences and the other the hori-

zontal effects of distribution. I am studying the genus *Lycæna* and think many names will eventually have the same value as those under *pseudargiolus*, of which we now have nine names. They represent what many of the others will in the future—gradational geographical forms and seasonal variations. When people put date and locality on the pins we will be able to find out these things. I have expressed my views in regard to *Pamphila*. See Can. Ent., Vol. XXVII, p. 261. The variations of *comma* should not be entitled to specific value. The species in *Nisoniades* are in bad shape and need careful study. I believe we have some synonyms among them. The species of *Aegiale* are interesting, and may be modifications produced by season, condition of food plant, etc. *Neumoegeni* is a very distinct species. The others are more nearly related.

DESCRIPTION OF THE LARVÆ OF SOME HETEROMEROUS AND RHYNCHOPHORUS BEETLES.

(Plate IV, Figs. 1–6)

BY H. F. WICKHAM.

The following descriptions have been written for the sake of making known to American students the immature stages of some of our beetles. In view of how little has been done in this country, it will not surprise most Coleopterists to hear that they all belong to genera in which none of the species peculiar to our continent have yet been studied in the larval state.

Nearly all of the details are from camera-lucida drawings of balsam mounts; they are, however, not all on the same scale, being made from time to time as leisure offered and with different instruments.

Megeleates sequoiarum *Casey*. (Fig. 1.)

Larva cylindrical, elongate, tapering slightly to each end. Color in spirits yellowish, head somewhat darker, mouth parts castaneous. Length 16 mm. Head barely perceptibly narrower than the prothorax, sides rounded, front nearly vertical, flattened. A distinct ridge runs down on each side of the frontal declivity to the base of the mandibles. The ocelli are situated on the upper or posterior portion of this ridge and are connected with each other by a transverse, very tortuous raised line. Antennæ situated exterior to the mandibles, apparently four-

jointed, although what appears as the first joint may possibly be merely a cephalic process. The second and third joints are of about equal length, though the third is of much less diameter; the fourth is small and springs from a termino-lateral point instead of from the center of the tip of the third. Mandibles very heavy; in lateral outline they show a strongly bidentate tip, while the inner edge near the base is serrate. One mandible (in a balsam mount) shows also a strong tooth just above the serrated portion. Maxillæ with subcylindrical outer lobe, which is somewhat smaller toward apex; inner lobe sub-reniform, face with numerous shortish spines; palpus 3-jointed, joints not greatly differing among themselves in length but decreasing gradually in thickness. Mentum slightly elongate, truncate at tip, ligula with sides oblique from the base to the broadest portion, which is slightly posterior to the point of insertion of the palpi; angles rounded, apex with median prolongation bearing at tip a pair of rather short divergent bristles; palpi two-jointed, the second joint slightly shorter and much more slender. A dissection exposing the upper floor of the labium shows a basi-median parabolic band of pubescence (see Fig. 1, mt.), surrounding a strong brown chitinous piece, articulated to another support at its posterior extremity. A similar structure is found in the mouth of *Hymenorus*. Clypeus about twice as broad as long, narrower anteriorly, angles rounded; labrum somewhat semicircular in outline, surface bristled as shown in figure.

Prothorax longer than the meso or metathorax, the last two about equal to each other. Abdomen of nine segments, the first seven differing but little in length among themselves, the eighth a little shorter, the ninth much so; it is terminated by a pair of short spines springing from the dorso-posterior margin. Legs short, coxæ conical, trochanters triangular in lateral view, outer side much the longest, femora broader at tip, tibiæ narrowed to apex, claw curved, simple, bearing two bristles near the base on the lower surface. Spiracles nine, the largest situated near antero-lateral mesothoracic margin; segments one to eight of the abdomen, each with one near the latero-median point.

The specimens described were given me by Dr. F. E. Blaisdell, who obtained them in woody fungi in Calaveras Co., California.

Meracantha contracta *Beauv.* (Fig. 2.)

Form elongate cylindrical, not tapering; color yellowish or brownish, the head and dorso-median portions of all the segments darker, ventral surface paler than the upper. Length of full grown specimen 19 mm. Head slightly narrower than the prothorax, shining, rather

finely and not densely punctured; there is an impressed line on the front extending in a parabolic course from the base of one mandible well up on to the vertex, thence curving around and running down to the other mandible. Bristles few but long. Antennæ four-jointed, first joint much broader and somewhat longer than the second, which is in turn slightly broader but much shorter than the third; fourth joint very small, tipped with one long and two short bristles. Ocelli are situated on the sides of the head behind the bases of the antennæ. Labrum transverse, sides rounded, anterior margin truncate and slightly sinuate, angles broadly rounded. There are three long bristles on each side and a series of about fourteen shorter ones around the margin. Mandibles very heavy and strongly toothed; a side view is figured; other aspects show that the tip is emarginate or bidentate. Maxillæ armed on the inner face with a regular series of strong spines; there are also a few smaller scattered spines on the surface. Palpi three-jointed, first and second joints about equal in length, the latter narrower, third joint smaller and shorter. The second joint bears two very long bristles, the others are smooth. Mentum subcordiform in outline, ligula very small, tipped with two short spines, palpigers broad, palpi heavy, the first joint much smaller than the second.

Prothorax about twice as long (on dorsal surface) as the mesothorax, the anterior side margin oblique, so that the segment is shorter on the ventral surface than on the dorsal. The scute is slightly roughened, but shining, the whole anterior margin marked with very fine longitudinal rugosities. The mesothorax is short, the metathorax about one-half longer, surface sculptured like that of the prothorax except that there are none of the fine longitudinal rugosities. Abdomen of nine segments, the first eight of which are almost alike, very convex above, ventral surface with a deep longitudinal impression each side Ninth segment obliquely truncate and deeply excavated on upper surface, the excavation coarsely rugose, ventral surface with numerous bristles. From the region of the suture between this segment and the eighth protrudes on the ventral aspect a small brown semicircular plate, tipped by two papillæ. Spiracles in nine pairs, the largest being situated on the under surface of the mesothorax in front of the coxæ, while the remainder are found on the abdomen near the anterior margin of the sides of segments one to eight. Legs moderate, not differing much in length among themselves, the anterior pair a trifle stouter, coxæ very prominent, claw sharp, curved in lateral aspect (it is twisted out of place in the camera-lucida drawing) and armed beneath with two spines or bristles.

These larvæ are found occasionally about rotten wood near Iowa City and are remarkable for the shape of the last abdominal segment. The change to pupa takes place in April, one of mine pupating on the twenty-second of the month, the beetle appearing on May fourth. The pupa is white, lying naturally in a curved position. Length, measured along the chord of the arc, 14 mm. The sides of the abdominal segments are armed with flattened processes, bearing each a short spine at tip; these processes are two in number on each side of the second, third, fourth and fifth segments; on the first segment there is but one, a short one, while the single one on the sixth is of moderate size. The last segment is excavated above and armed with a pair of long sharp terminal spines.

Hymenorus obscurus *Say.* (Fig. 3.)

Larva very elongate, slender, subcylindrical; back very convex, venter flattened, and with a longitudinal furrow on each side. Color, in life nearly white, in spirits yellowish, surface shining. Length, 12 to 13 mm. Head about as wide as the prothorax and of darker color than the rest of the body, antennæ four-jointed, first and second joints about equal in length, the first broader; third joint about one and one-half times as long as the second, rounded at tip, a ring of small spines surrounding the subterminal enlargement; fourth joint small, papilliform, trisetose at tip. Labrum more than twice as broad as long, sides rounded, apex truncate or very slightly emarginate, margin bristly, a few scattering spines on the surface, under face with a parabolic band of small spines (See Fig. 3 lbr.). Mandibles very heavy, deeply emarginate, strongly toothed, and with a broad basal molar portion. Maxillæ with two rows of very strong spines on the inner face, as well as numerous scattered ones. Palpal joints decreasing gradually in thickness, apparently four in number, as shown in Fig. 3 max.; there is, however, some slight damage done to the basal portion in my preparation, so that I do not feel quite sure. The last joint has a fringe of small spines around the tip. Labium of moderate size, palpi thick, second joint narrower; the prolongation of the tip of the ligula is of considerable size, nearly reaching to end of first palpal joints, and bears at apex two bristles about equalling it in length. The chitinous supports are two—the basal piece about as broad as long, rounded at base, rather deeply emarginate and distinctly sinuate at tip, angles prominent; the apical piece elongate, narrow and deeply notched at tip. Prothorax longer than the mesothorax and metathorax, which are about equal to each other in length. The mesothorax bears a spiracle on

each side in front of the coxæ. Abdomen of nine segments, the first eight about equal in size, each bearing a pair of spiracles, which are situated near the antero-lateral margin; ninth bluntly conical, bristly, beneath with a pair of papilliform appendages projecting from beneath a plate lying near the anterior margin. Legs moderate in length, very bristly, coxæ very prominent, claw not toothed.

The larvæ were found in a rotten oak stump, and were at first taken to be Elateridæ. The change to pupa took place April 27th, the beetle appearing May 6th. The pupa is white, 7 mm. long; sides of abdomen with compressed three-toothed processes; terminal segment with two short curved spines.

Acamptus rigidus *Lec.* (Fig. 4.)

Living larva white, head yellowish, mandibles castaneous. Form rather short, robust, position at rest, curved. Length 5 mm., width almost 2 mm. Head large, deflexed, oval in frontal view. A rather deep impressed line runs the length of the median region above. Surface rather sparsely bristly, the bristles longer and more numerous near the sides. The antennæ cannot be made out distinctly, but are very short and borne in pits over and outside of the mandibles. Eyes are wanting. Mandibles heavy, triangular, strongly chitinized, inner edge sinuate and with a strong tooth near the tip. Maxillæ heavy, basal portion furnished on the masticatory face with several (eight or nine) strong articulated spines; palpus two-jointed, the joints thick, basal one the thicker and somewhat the longer. Mentum mostly membranous, the basal portion therefore indistinctly limited. The terminal part bears four moderate spines at tip; the palpi are two-jointed, the basal joint much the longer. Thoracic segments membranous, broader than the head; they do not bear legs, but each has on the ventral surface a pair of large tubercles which bear ambulatory bristles—about six to each tubercle but not all of the same length. Abdominal segments not well differentiated from the thoracic, soft in consistence, the terminal one obtuse. All the segments are bristly towards the sides, and on the back are seen four long bristles which arise near the tip of the abdomen. The median portion of the ventral surface is devoid of them. The dorso-terminal portion of the abdomen has a squamose appearance, but under a high power these apparent squamules are seen to be short sharp spines.

Larvæ were sent me by Mr. A. B. Wolcott from near Bloomington, Illinois; they were taken, March 13th, from the interior of a soft maple tree. According to Mr. Wolcott's account, this tree had received, at a

point about five feet from the ground, an injury which had removed the bark, the exposed place then being attacked by the large horn-tail, *Tremex columba*. For about an inch from the surface the wood was quite hard, but inside of this shell was quite badly decayed and soft. The young *Acamptus* larvæ were found just entering the soft wood on sides of the Tremex burrow, while the large ones were taken at the end of a gallery of an inch or two in length, this gallery having its origin from the side of that of the *Tremex*. The full grown larvæ had formed, at the date mentioned, rounded cells, apparently for pupation; these cells had no evidence of silk in their construction. Mr. Wolcott has kindly furnished a drawing to illustrate the work of this larva (Plate IV, Fig. 6). The burrow of the *Tremex* is shown at Tr, while that of the *Acamptus* is marked Ac. The black spots in the latter show where the larva had made short secondary burrows for the depth of an eighth of an inch or so. All of the larvæ taken by Mr. Wolcott were found with the head pointing upward, whether the burrow ran up or down. This may simply be the position of rest for the winter. A few adults were taken with the young, at the date cited, but they were more numerous in November preceding. None have been seen on the outside of the tree, nor do any of the healthy trees seem to have been attacked.

Yuccaborus, sp. (Fig. 5.)

Larva robust, natural position curved, consistence soft. Color nearly white, head testaceous, mouth dark brown. Head more strongly chitinized than the rest of the body, its upper surface sparsely bristled, median line distinct for about one-half of the distance from the hind margin when it forks, separating into two lines, one of which extends towards each anterior angle. Antennæ extremely short and contained in pits at the sides of the head near the mandibles. Clypeus separated from the front by a distinct suture; in form transverse, approximately, thrice as broad as long, narrower anteriorly, sides oblique. Labrum as broad as the anterior margin of the clypeus but shorter than the sclerite, sides rounded, bristled as shown in the figure. Mandibles extremely heavy, triangular in outline, the inner margin irregular but without defined teeth. Maxillæ with very heavy base, inner face flattened and armed for about one-half of its length with a dense covering of bristles. Palpi two-jointed, the first joint much stouter than the second. Labia palpi two-jointed, almost like the maxillary; the ligula is emarginate at tip, and each of the projections thus formed bears a bunch of bristles at apex. Prothorax about as long as the meso- and meta-thorax combined,

dorsal shield strongly chitinized and with a yellowish tinge. There are no legs, but each of the thoracic segments bears on its ventral surface a pair of setigerous tubercles which are doubtless locomotive in function. Abdomen increasing gradually in size from the first to the third segment, thence gradually decreasing to the fifth. The remaining segments (apparently three in number) are much smaller than the preceding and decrease more rapidly in size. The eighth segment is deeply and broadly longitudinally sulcate, each of the lateral ridges (one of which bounds this excavation on each side) bearing an elongate setigerous tubercle near the anterior and another near the posterior border. The whole ventral surface of the body is traversed by rather deeply impressed longitudinal lines, which, running crosswise of the segmental incisions, give a somewhat tuberculate appearance to this region. On the dorsal surface the plications are parallel to the segmental incisions. Length 10 mm.

Pupa tolerably closely reproducing the form of the beetle, the head and beak sparsely set with short and sharp spines. The pronotum bears a pair on the median line near the base; on each side of and a little posterior to this middle pair lies another pair, and, still exterior, another. The anterior portion of the pronotum bears one spine on each side near the front margin, separated from each other by a space somewhat less than the width of the head; behind and somewhat to the side of these spines are two others, one on each side. The meso- and meta notum each bear two rows of spines which converge posteriorly. The abdominal segments are armed with transverse rows. Length 12 mm.

Numerous pupæ and adults with one larva were found near Brownsville, Texas, infesting a dead yucca. They occur in the decaying portion immediately underlying the old bases of the leaves. The specific identity of the beetle is not settled, but it may turn out to be the same as one of the Mexican species.

EXPLANATION OF PLATE IV.

Fig. 1. Megeleates sequoiarum *Casey*.
Fig. 2. Meracantha contracta *Beauv.*
Fig. 3. Hymenorus obscurus *Say*.
Fig. 4. Acamptus rigidus *Lec.*
Fig. 5. Yuccaborus, sp.
Fig. 6. Piece of wood from soft maple tree, showing burrow of *Acamptus* (Ac.) springing from burrow of *Tremex* (Tr.).

All details are marked alike, viz.—lbr.=labrum; Mt.=labium; Md.=Mandible; Max.=Maxilla; ant.=antenna.

THE LIFE-HISTORY OF THE FLORIDA FORM OF EUCLEA DELPHINII.

By Harrison G. Dyar, A. M., Ph. D.

(Plate V, Figs. 1–13.)

Larvæ found at Lake Worth, Florida, in January, 1896, differed from any previously seen by me, and were supposed to represent some species of *Euclea* or *Monoleuca* not previously bred. However, the moths which emerged proved to be *E. delphinii*. I present herewith an account of their life-history in advance of that which Miss Morton and I will work out of the New York form, since I have been fortunate enough to observe all the stages. I am much indebted to Mr. F. Kinzel, of Palm Beach, for a supply of food plants during the winter months.

The larvæ are nearest in pattern and structure to the form provisionally called *E. pœnulata* (*elliotii*) by Miss Morton and myself (Journ. N. Y. Ent. Soc., III, 146). They differ in coloration and in having a pair of caltrope patches on the subdorsal horns of joint 13, which are absent in *pœnulata*. In both there is a single group of detatchable spines and the subdorsal line is unbroken by discolorous patches. The synonymy and relations of the several forms of the *delphinii* group, as well as figures of the caltropes and spines will be deferred to our paper on the New York species, where we hope to discuss these matters in full.

Special Structural Characters.

Dorsal and lateral spaces broad, subventral space narrow, contracted; ridges very slight, the lateral the most distinct, approximate to the subventral. Fleshy horn-like processes unequally elongated; in stage I bearing primitive setæ; after first molt the subdorsal and lateral rows covered with numerous urticating spines, mixed with less developed spines bearing setæ; subventral row rudimentary. The subdorsal horns are well developed on joints 3 to 5 and 11 to 13, moderate on joint 8, very small on 6, 7, 9 and 10, but none are rudimentary as they are in *Sibine*. Of the lateral row the one on joint 5 is absent.

Depressed areas feebly developed, usually only their pale glandular centers visible, under favorable circumstances also the areas themselves as slight hollows, smoother than the general surface; dorsal row (1) paired, double between joints 3–4 and 4–5, ad-dorsal (2) slight;

the lateral row (4) and lower intersegmental lateral (6) quite distinct, the former reniform.

Skin at first smooth, in the later stages covered with minute clear, conical granules, rather sparsely distributed. These little granules are intermediate in development between the sharp-pointed skin spines of *Sibine* and the low, rounded, smooth, colorless granules of *Apoda*. They are not present on any of the horns, which are armed only with the spines and setæ. Caltrope patches appear toward the tip of the horns of the lateral row at about stage VII. They are present on joints 6 to 12 and also on the subdorsal horn of joint 13. In the last stage a single pair of detachable spine patches appears, situated above the subdorsal horn of joint 13, the patch small, slender, obliquely truncate.

The coloration is on the whole mimetic and adapted to escape observation. These larvæ persistently hide by day in their native habitat, creeping into curled leaves or any other similar protected place on their food plant.

The larva is closely comparable with *Sibine* (Journ. N. Y. Ent. Soc., IV, 2), on the whole slightly less specialized, as seen by the smaller and imperfectly developed detachable spines and the less unequally developed horns. Its skin structure is, however, considerably higher than that of *Sibine*.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Eggs.—Laid singly, or in patches of two to seven, slightly overlapping. Flattened, the upper surface low arched, elliptical, but not of a constant shape; 1.6 x .9 x .2 mm., or about these dimensions, varying in thickness as well as in outline. Nearly transparent as seen on the leaf, milky whitish on glass, and pale lemon yellow on white paper, shining; reticulations obscure, narrow, linear, angularly 4 to 6-sided areas, only seen in a strong direct light. The eggs hatch in seven days from the time they are laid.

Stage I.—The embryo forms as usual curved ventrally, flattened laterally, the head and tail touching. Before hatching it shortens and thickens slightly, but still well compressed, and emerges through a hole at the top of the egg. Head pale with a large black eye; width about .2 mm, retracted beneath joint 2, which may be partly retracted below joint 3. Body rather square, the horns all present as described for the mature larva, but the short ones relatively longer (Plate V, Fig. 1). The arrangement is as in *Sibine* and is shown on the plate. The subdorsal horn on joint 8 is only partially reduced in size. There is a tendency

for the smallest horns to be crowded toward the neighboring large ones, whereby the subdorsal horn on joint 6 approaches the one on 5, that on 7 the one on 8, etc. Setæ rather long, stiff, sharp pointed, three from the apex of each horn. Cuticle perfectly smooth, transparent. The larva is pale yellowish, the color of the egg, without marks. It does not feed at all in this stage, becoming quiescent immediately after hatching and molting in three days. Length of larva 1 mm.

Stage II.—Subdorsal horns on joints 3 to 5, 8, 11 and 12 large, rounded, bristly with stiff, black-tipped spines; those on joints 6, 7, 9 and 10 very small, rounded, each with one spine; lateral row with many spines, the horns on joints 3 and 4 larger than the rest. Body squarish, ridges marked by the large tubercles, widest through joints 3 and 4. All pale yellowish white, much more opaque than before. Skin finely granular dotted; no marks. Head pale, eye black, mouth brown, width .3 mm. Toward the end of the stage the horns of subdorsal row on joints 4, 5 and 11 become brick red in some examples. Length 1 to 2 mm.

Stage III.—Very shining, green, but principally from the alimentary canal showing by transparency. A narrow, faint yellow subdorsal line along the ridge; horns on joints 3 to 5, 8, 11 and 12 bright red; lateral row colorless with green tips. The horns are moderately well covered with black-tipped spines; the subdorsal ones on joints 6, 7, 9 and 10 have only one or two spines. Skin finely and rather remotely watery granular. Dorsal and ad-dorsal depressed areas indicated by whitish dots, also the large lateral intersegmental (4). The larvæ eat rounded patches on either side of the leaf (Plate V, Fig. 13). Width of head .4 mm.; length of larva 2 to 3 3 mm.

Stage IV.—Resembles the mature larva in shape and appearance. Green, a narrow yellow subdorsal line, the same horns red as before. The subdorsal horns on joints 6 and 10 are very small with three or four spines, those on joints 7 and 9 moderate with six to eight spines. A narrow pale dorsal line. Double intersegmental dorsal, ad-dorsal and two lateral obliquely set rows of white glandular dots. The lateral horn on joint 4 is a little larger than the others. Head whitish, the eye black; width .6 mm. Skin granules rather remote, concolorous or colorless, non-setiferous, conical but not sharp pointed, about .005 mm. in diameter. All the horns are smooth, without skin granules. No trace of caltropes. Length of larva 3.3 to 5.3 mm.

Stage V.—Head shining, very pale greenish, eye black, mouth brown; width .8 mm. Green; the skin transparent with a faint green

tint from the blood, the effect increased by some bright green pigment, not evenly distributed. In the dorsal space it is absent between the large horns, being therefore especially noticeable in two square patches on joints 6–7 and 9–10. Between these patches and the yellow subdorsal line is a slight space which will become the waved dark green line; but as yet it is not indicated. Yellow subdorsal line broad, irregular. In the lateral space the green pigment is situated in a band below the subdorsal line, separated from it by a space which is already defined faintly as a dark green line. The green pigment encloses the upper intersegmental whitish dots, but below this the body is only green from the blood. A narrow distinct whitish dorsal line. Horns greenish except the six red pairs. The short horns are as well spined as the long ones, in proportion. Skin finely watery granular. Length 5.3 to 7 mm.

Stage VI.—Elliptical, flattened, highest through joint 5, though not conspicuously so. Green, dorsum flat, not tapering much at the ends, yellowish green, a narrow yellow dorsal line and a dark clear green waved line above the subdorsal band; intersegmental glandular dots whitish; the green band is most pronounced on joints 6 to 10, giving the appearance of a central darker green patch, but this disappears under a lens. Subdorsal line rather broad, yellow, extending from joints 3 to 13. Horns short and slender, the longest ones on joints 3, 4, 5, 8, 11 and 12 bright red, the others moderate, colorless. Lateral space nearly colorless, shaded with light green on the lateral ridges between the depressed spaces, two rows of white glandular dots in the broad intersegmental hollows. Lateral horns rather long, alike, pale green, those on joints 3 and 4 tipped with brownish. A broken, pale lateral line. Subventral space contracted, colorless. Head green, jaws brown, ocelli black; width 1 mm. Spines colorless; skin with fine clear granules. Length of larva 7 to 10 mm.

Stage VII.—Essentially the same. There are now present a series of caltrope patches toward the tips of the lateral horns on joints 6 to 12, and on the subdorsal horn on joint 13. Width of head 1.6 mm. Length of larva 10 to 14.5 mm. The dark green lines adjoining the subdorsal and lateral ridges vary in distinctness in different larvæ, gradually becoming more distinct as the larvæ grow.

Stage VIII.—As before. The red horns vary in color in different examples, some being faintly colored or even greenish. A pair of pointed, slender, pale brown, black-tipped patches of detachable spines above the subdorsal horn of joint 13; caltrope patches pale

brown, on the upper side of the lateral horns of joints 6 to 12 and on the sides of the subdorsal horn of joint 13. Larva pale yellowish green, a yellow subdorsal band below the skin on joints 3 to 13, edged below by a dark green line, narrow, rarely partly replaced by red (Plate V, Fig. 3); a deeply waved green line above the subdorsal and lateral ridges, both edged with yellowish. Dorsal yellow line faint. Intersegmental glandular dots whitish. The subdorsal dark line is faint at the extremities, but gives no longer any appearance of a central patch. Skin sparsely watery granular. Width of head, about 2.5 mm.; length of larva, 14.5 to 20 mm.

Cocoon and pupa as usual. The cocoon is 11 x 6.5 mm. in size and is surrounded by a slight irregular web; color, dark brown.

Food Plants.—The larvæ were found each on a different plant, as follows: Mangrove (*Rhizophora mangle*), Sea Grape (*Coccoloba uvifera*), Cocoanut Palm and *Coccoloba floridana*. All the four larvæ produced moths; the last two mated in the box, and I obtained from them eggs and finally 95 little larvæ. These ate whatever was offered them, as is usual in the Eucleidæ.

EXPLANATION OF PLATE V.

Fig. 1. Larva stage I, lateral aspect, semidiagrammatic × 50; head protruded.
Fig. 2. Larva stage I, dorsal aspect × 40; head retracted.
Fig. 3. Mature larva × 5; three-quarters view, head retracted in the ordinary position of rest.
Fig. 4. Outer part of a thoracic foot of mature larva × 200 showing the claw and terminal setæ.
Fig. 5. Jaw of same × 50 seen from within.
Fig. 6. Spiracle × 50 showing radiate structure.
Fig. 7. A simple seta and tubercle, mature larva, × 50.
Fig. 8. Another, showing the tubercle elongated.
Fig. 9. The same, further advanced.
Fig. 10. A short urticating spine, the seta reduced to the piercing cap, the tubercle forming the poison-holding shaft.
Fig. 11. The same; a larger spine from a long horn.
Fig. 12. One of the exceptional flattened setæ × 200.
Fig. 13. Leaf showing the feeding traces of the larva in stages II and III, natural size

NEW SPECIES OF AMERICAN HETEROCERA.

BY WILLIAM SCHAUS.

Eurata helena, sp. nov.

Head and thorax black; two round yellow spots on collar. Abdomen above with segments 1–3 crimson, 4 and 5 yellow; otherwise black; a broad black subdorsal line from the base and a tinge of black between the segments. Wings brownish black, thinly scaled. The primaries with two contiguous white spots near the end of the cell, and another spot below them; beyond the cell four white spots, the lowest very minute; at the base two minute yellow spots. Secondaries with two white spots at the end of the cell and the inner margin broadly crimson. Underneath the same. Expanse, 34 mm.

Habitat: Castro, Parana.

Eurata maritana, sp. nov.

Head and thorax black; collar with two large yellow spots. Abdomen with the basal segments crimson and a black and orange subdorsal spot, segments 2 and 3 black with lateral spots; segments 4 and 5 yellow separated by a transverse black band; otherwise black underneath, segments 4 and 5 are yellow. Wings smoky black. Primaries with an oblong creamy spot at the base; two large white median spots; four large white subapical spots. Secondaries with a trace of a whitish line at the end of the cell. Expanse, 36 mm.

Habitat São Paulo, S. E. Brazil.

Allied to *E. picta* H. S.

Syntomeida broadwayi, sp. nov.

Antennæ and head black with a metallic green spot. Collar black with two small metallic pale green spots. Patagiæ black with two similar but larger spots Thorax and abdomen dorsally dark metallic green, the segments of the abdomen very distinct; underneath black with a large white patch at the base of the abdomen. Legs dark metallic blue; fore femora white; tarsi with a broad white circle and a crimson streak above the white circle on the fore pair. Primaries dull greenish black with the following small vitreous spots; one below the median vein at a third from the base; one at the end of the cell; two just beyond the cell; a slightly larger spot near the outer margin between veins 2 and 3, and a minute spot just above it separated by vein 3. Secondaries of the same color, with a small vitreous streak at the base on the inner margin, and adjoining it a minute round spot; another small vitreous spot at the end of the cell. Underneath the wings are dark metallic green. Expanse, ♂ 41 mm.

Habitat: Trinidad, B. W. I.

I am indebted for a specimen of this new species to W. E. Broadway, Esq. of the Botanical Gardens

Chloropsinus ænetus, sp. nov.

Body velvety black. Primaries dark bronzy green with the veins still darker. Secondaries smoky black with a faintly diaphanous streak at the base. Expanse, 33 mm.

Habitat: Castro, Parana.

Allied to *Chloropsinus viridis* Druce.

Eupyra ferens, sp. nov.

Head and thorax blackish. Three white points on the collar and one at the base of the primaries. Abdomen greenish black with a subdorsal, lateral, and ventral row of white spots. Wings dark metallic green. Expanse, 45 mm.

Habitat: Peru.

Allied to *E. bacchans* Schs.

Eupyra albicincta, sp. nov.

♂. Antennæ dark metallic blue. Head black. Collar white. Thorax black. Abdomen metallic blue; the base broadly white which gradually extends laterally and underneath. Legs black streaked with metallic blue and white; fore coxæ white. Wings metallic peacock blue, with the veins and fringe black; a large oval vitreous spot at the base of the secondaries; the cell and costal margin of the secondaries blackish. The ♀ differs in having a small vitreous spot on the primaries below the median vein at about the middle of the wing, and there are two small vitreous spots in the cell of the secondaries. Expanse, ♂ 45 mm., ♀ 50 mm.

Habitat: Chimbo, Ecuador.

I received this beautiful species from Mr. Oberthür.

Eupyra sylva, sp. nov.

Head and thorax brown; two minute white spots on collar. Abdomen golden brown; a large subdorsal white spot at the base and some lateral white spots on the first four segments. Primaries golden green with the following vitreous spots; a large one about the middle of the wing below the median vein; a small one at the end of the cell, and another minute one beyond the cell; near the outer margin a large spot between veins 3 and 5, crossed by vein 4. Secondaries brownish black; the inner margin with long white hairs; a large vitreous spot at the base, followed by a similar spot about the center of the wing. Expanse, 37 mm.

Habitat: Rio Janeiro.

Very closely allied to *E. cephalena* Druce.

Sphecosoma melissa, sp. nov.

Head white spotted with black. Collar yellow. Thorax yellow, with five black streaks. Abdomen: basal segment black with two yellow spots, the other segments yellow banded with black and a fine subdorsal black line. Legs yellow. Wings yellowish hyaline with the margins and veins finely brown; some yellow at the base of the inner margin on the primaries. Expanse, 23 mm.

Habitat: São Paulo, S. E. Brazil.

Cosmosoma lucia, sp. nov.

Body black above with a subdorsal row of metallic blue spots from the head to the anal segement. Underneath, thorax and legs red. Wings hyaline margined with black, widely at the apices; veins black, especially the discocellulars on the primaries. Expanse, 36 mm.

Habitat: St. Lucia, B. W. I.

Cosmosoma durca, sp. nov.

Body black with a subdorsal and a lateral row of metallic green spots. Wings hyaline. The primaries with the base and margins broadly black, the costa narrowly so; a black spot at the end of the cell. Secondaries with the outer margin black. Expanse, 31 mm.

Habitat: São Paulo, S. E. Brazil.

Cosmosoma dukinfieldia, sp. nov.

Head black with a blue spot. Thorax black, a grayish spot on the patagiæ. Abdomen black shaded with metallic blue at the base and laterally. Wings hyaline. Primaries with the base and outer margin broadly blackish brown; the costal and inner margins mottled pale fawn colour and black; a broad black spot at the end of the cell; all the veins black. Secondaries with the outer margin black. Underneath the thorax is spotted with metallic blue. Expanse, 42 mm.

Habitat: Castro, Parana.

Sansaptera, gen. nov.

Antennæ pectinated. Palpi porrect, second point long. Primaries long and narrow, the outer margin very oblique, the inner angle rounded; the submedian vein very short. Secondaries very minute, almost imperceptible, with the anal angle prolonged.

Sansaptera cocho, sp. nov.

Head black with two metallic points. Thorax black; two metallic blue spots on the collar. Abdomen black with a subdorsal and a lateral row of metallic scales; underneath white at the base. Primaries hyaline, veins and margins black, the outer margin broadly so; a black spot at the end of the cell; the base black with some metallic spots. Secondaries brownish black. Expanse, 29 mm.

Habitat: Cavallo-cocho, Peruvian Amazons.

Argyrœides sanguinea, sp. nov.

Antennæ black. Head black with white lines. Collar yellow. Thorax black; a yellow line on patagiæ. Abdomen black at the base with a yellow spot; the second segment yellow; otherwise crimson dorsally with three transverse black streaks; beneath and laterally black; anal tuft black. Wings hyaline, finely margined with black. Discocellulars more heavily black on the primaries. Expanse, 24 mm.

Habitat: Castro, Parana.

Syntrichura brodea, sp. nov.

Head black spotted with white. Body dorsally brilliant metallic green, the

patagiæ edged with black; underneath the coxæ and a large spot on the abdomen white. Wings hyaline with black margins. The costal margin of the secondaries white. Expanse, 28 mm.

Habitat: Trinidad, B. W. I.

Philoros marita, sp. nov.

Antennæ black. Head gray; orange behind the antennæ. Collar and thorax light brown; the patagiæ dorsally shaded with yellow. Abdomen black. Primaries light brown; the median, submedian and veins 3, 4 and 6, finely yellow; fringe yellowish. Secondaries dull black; fringe white. Underneath blackish gray, the disc of the primaries paler. Expanse, 30 mm.

Habitat: Castro, Parana.

Pygoctenucha dukinfieldia, sp. nov.

Head crimson. Collar crimson with a black lateral spot. Thorax crimson; patagiæ black. Abdomen black; anal segment crimson. Legs black; red at the joints. Wings dull black. Expanse, 51 mm.

Habitat: São Paulo, S. E. Brazil.

Allied to *P. bombycina* Perty.

Aclytia terra, sp. nov.

Head and thorax dark brown; a metallic blue point between the antennæ. Abdomen metallic blue; a subdorsal black line and transverse black bands on the segments; at the base long tufts of brown hairs; coxæ orange; a ventral orange band. Primaries dark brown. Secondaries black with a broad diaphanous streak from the base to beyond the cell. Expanse, 34 mm.

Habitat: Castro, Parana.

Allied to *A. conspicua* Druce = *lucania* Schs.

Charidea katima, sp. nov.

♂. Head black and blue. Collar metallic blue. Thorax black with three metallic blue streaks. Abdomen metallic blue. Fore coxæ white; Primaries black shaded with blue at the base, the submedian vein and a broad streak above it red; a broad oblique red band beyond the cell, from the subcostal vein to nearly the outer margin above the angle. Secondaries with the basal half rich metallic blue, the outer half black. Underneath the same without the red basal streaks on the primaries. Expanse, 36 mm.

Habitat: São Paulo, S. E. Brazil.

Eucereon amadis, sp. nov.

Head and thorax dark brown; two minute reddish yellow spots behind the antennæ. Abdomen chrome yellow; black at the base and subdorsally on second segment; a lateral black line; Anus black. Primaries dark brown; the veins, an angular basal line, a small spot in the cell, a transverse outer line forming a large curve beyond the cell and reaching the inner margin about its center, and a terminal row of angular spots yellowish brown; the terminal spots filled in with darker

brown. Secondaries semi-hyaline, whitish, the veins and the margins dusky black. Underneath the primaries are black with some vague whitish spots beyond the cell. Expanse, 39 mm.

Habitat: Jalapa, Mexico. Also in coll. British Museum.

Eucereon patrona, sp. nov.

Head, collar and thorax pale brownish gray, with a broad velvety brown lateral streak. Abdomen dorsally crimson with some black hairs subdorsally on the first three segments; laterally a broad black streak; anus black; underneath yellow. Primaries pale brownish gray with some dark but indistinct streaks along the margins forming vague transverse lines, which become lost in a broad velvety brown shade extending from the base to nearly the apex. Secondaries whitish, semi-hyaline, the veins and fringe brownish; the apex and anal angle clouded with brown. Expanse, 43 mm.

Habitat: Aroa, Venezuela; Orizaba, Mexico.

Eucereon velutina, sp. nov

Head and thorax gray; patagiæ brown. Abdomen dorsally with the basal half black, the anal half orange with subdorsal and lateral black spots. Underneath blackish with two yellow stripes. Primaries rich brown, paler at the base of the inner margin; a basal dark line from the costa; a narrow triangular dark space on the outer margin; an outer wavy line almost imperceptible above vein 4, but very dark and becoming broader below it to the inner margin. Secondaries smoky black; the costal margin yellowish; a black point in the cell. Expance, 27 mm.

Habitat: São Paulo, S. E. Brazil.

Eucereon cinctum, sp. nov.

Head black; reddish posteriorly. Thorax smoky brown with some pinkish streaks and a pink subdorsal spot posteriorly. Abdomen black above with a broad crimson space before the anal segment; underneath brownish with two yellow streaks. Primaries smoky black with the veins, a basal, an outer and a submarginal transverse line fawn color; a slight diaphanous spot in the cell and another beyond it. Secondaries hyaline with the outer margin broadly black. Underneath the primaries are black spotted with white. Expanse, 27 mm.

Habitat: Trinidad, B. W. I.

Erithales capsica, sp. nov.

Head pale gray with a minute black spot. Collar pale gray with two large black spots. Thorax pale gray; a black dorsal line; two small spots on patagiæ. Abdomen above gray at the base, otherwise pink with a dorsal grayish line. Underneath white. Primaries grayish white with black spots as in *E. guacolda Poey*, but larger. Secondaries with the base semi-hyaline white, the outer half gray. Underneath the wings are dark. Expanse, 33 mm.

Habitat: São Paulo, S. E. Brazil.

Allied to *E. guacolda* Poey, and *E. quadricolor* Walk. which is wrongly placed under *Theages* in Kirby's Catalogue of Moths. The

genus *Erithales* will no doubt sink as a synonym of *Eucereon*, or the latter must be divided into several genera. Of the twenty-nine species I possess I make five groups according to slight differences in neuration.

Amaxia juvenis, sp. nov.

♂. Head yellow above, crimson underneath. Collar yellow. Thorax violaceous brown. Abdomen crimson above, yellow ventrally. Primaries bright yellow; a large violaceous brown space from the costal vein at a third from the base to the inner angle, except the costal margin itself, which remains yellow, and a small yellow spot at the middle of the inner margin, this latter spot being edged with crimson; and there are also some crimson scales at the base of the inner margin; some dark grayish spots in the cell; beyond the cell three transverse rows of spots, the first and outer rows small, the center row also small except towards the outer margin where they become large and confluent and are more or less shaded with crimson; the extremeties of the veins crimson. Secondaries pink; broadly yellowish along the costal margin.

♀. Differs in having the dark basal space broken up into large spots more or less broken up into large spots more or less confluent, and the rows of transverse spots especially the central row, consists of a series of large spots edged with crimson. The thorax is also mottled with yellow. Expanse, ♂ 33 mm., ♀ 42 mm.

Habitat: Jalapa, Mexico.

Amaxia dyuna, sp. nov.

Head yellow posteriorly shaded with crimson. Collar yellow. Thorax dark gray, mottled with yellow and crimson, the patagiæ finely edged with crimson. Abdomen above pink, mottled with yellow at the base; underneath white. Primaries bright yellow; at the base some small grayish spots circled with crimson, and beyond these a large similarly colored and irregular space extending from the subcostal vein to the inner margin, where it reaches the inner angle; two terminal rows of small dark spots; the median yellow space with some small spots and at a fourth from the apex four large and confluent brownish gray spots extending from vein 5 to the costal margin. Secondaries yellowish white, shaded with pink, along the inner margin. Expanse, 36 mm.

Habitat: São Paulo, S. E. Brazil.

Pseudalus, gen. nov.

Antennæ pectinated. Thorax broad. Abdomen slight, short. Primaries broad, outer margin oblique; veins 7–10 stalked; 6 from upper angle of cell. Secondaries broad; veins 3 and 4 nearly from a point at lower angle of cell; veins 5 and 8 absent; 6 and 7 stalked.

Pseudalus limona, sp. nov.

Head and legs orange, the latter spotted with black. Collar and thorax bright yellow. Abdomen whitish. Primaries bright yellow; three black points near the base and an oblique row of black points on the veins from the middle of the

submedian nervure to near the apex; a small black mark in the cell. Secondaries white. Expanse, 36 mm.

Habitat: São Paulo, S. E. Brazil.

Idalus citrina Druce is congeneric with this species.

Thalesa, gen. nov.

♂. Antennæ pectinated. Primaries broad, produced along the inner margin apex acute; inner angle rounded. Veins 7, 8, 9 stalked. Secondaries as broad as long; rounded at the apex and inner angle. Veins 5 and 8 absent; discocellular open in the ♂, forming an angle inwardly in the ♀. Vein 7 widely curved above vein 6. Veins 3 and 4 from lower angle of cell.

Allied to *Idalus* and *Eupseudosoma*. Type, *Thalesa* (*Halisidota*) *seruba* H. S. In the ♀ the wings are long and narrow as in *Halisidota*. *Thalesa seruba* is usually confounded with *Halisidota niveigutta* Walk. and the females can only be distinguished by the neuration.

Symphlebia aryllis, sp. nov.

Body orange yellow. Primaries bright yellow; the outer half of the veins brown; the subcostal vein to the end of the cell black, broadly bordered above with creamy yellow, containing a long black streak; a basal creamy yellow space above the submedian vein containing a short fine black streak. Secondaries testaceous Underneath testaceous. Expanse, 64 mm.

Habitat: Aroa, Venezuela.

This species is almost identical with *Lophocampa nervosa* Feld. (Reise Novara, T. 101, Fig. 6.) in its markings, but the neuration is different.

Castrica, gen. nov.

Antennæ finely pectinated. Primaries long and broad, the outer margin slightly produced, between veins 5 and 6; the neuration as in *Symphlebia*, Felder. Secondaries in the ♂ somewhat quadrate with the angles rounded. Vein 2 from lower angle of cell in the ♂, before the angle in the ♀; veins 3 and 4 stalked; vein 5 absent; vein 6 usually absent; sometimes present in the ♀ as a short branch of vein 7. Veins 7 and 8 from upper angle of cell in the ♂, slightly stalked in the ♀; a costal spur in the ♂.

Castrica oweni, sp. nov.

Body yellow. Wings yellow heavily shaded with smoky gray through the cell towards the apex and submarginally; a clearer spot in the cell followed by a dark spot. Secondaries pale yellow. Expanse, ♂ 41 mm., ♀ 47 mm.

Habitat: Venezuela, Costa Rica. Named after Prof. E. T. Owen.

Prumala, gen. nov.

♀. Antennæ finely pectinated. Primaries large and broad. Veins 4 and 5 from lower angle of cell; 6 from upper angle; 7–10 stalked. Secondaries broad, oval; veins 3 and 4 from lower angle of cell; vein 5 absent; 6, 7, 8, from angle of upper cell.

Prumala jamaicensis, sp. nov.

Head and thorax brown. Abdomen red. Primaries above brown; three spots in the cell; an outer and a submarginal row of small indistinct gray spots finely circled with dark brown. Secondaries pink. Underneath the wings are red with a small black spot on the primaries beyond the cell. Expanse, 49 mm.

Habitat: Jamaica, B. W. I.

Nezula, gen. nov.

Antennæ very long, minutely pectinated. Primaries long, narrow, the outer margin very oblique, the inner margin very short. Vein 6 from upper angle of cell; 7,8,9 stalked; 10 and 11 stalked. Secondaries triangular in the ♂ oval in the ♀; veins 3 and 4 stalked; 6 and 7 stalked in the ♀; veins 6 absent in the ♂; vein 5 absent in both sexes.

Nezula grisea, sp. nov.

Head and front of thorax yellow; body otherwise gray. Wings gray, darker in the female than in the male. Expanse, ♂ 21 mm., ♀ 24 mm.

Habitat: Aroa, Venezuela.

Trichromia (*Hübn*) **pandera**, sp. nov.

Head and thorax gray. Abdomen and secondaries bright yellow. Primaries violaceous gray with a very broad yellow space from the middle of the costal margin to the middle of the outer margin, slightly extending towards the apex on the extreme margin, giving the apical gray portion the appearance of a rounded spot. Expanse, 33 mm.

Habitat: Aroa, Venezuela.

This species closely allied to *Veritos repanda* Walk.

Bertholdia, gen. nov.

Antennæ finely ciliate. Body stout. Primaries with the outer margin convex below apex, then oblique. Veins 6–10, usually stalked, 6 sometimes from upper angle of cell. Secondaries triangular with the angles rounded. Veins 3 and 4 from lower angle; 5 from discocellular; 6 absent; 8 from cell following close along vein 7. Underneath on the primaries a ♂ sexual gland between the median and submedian veins near the base.

Named in remembrance of Berthold Neumoegen. Type of genus, *Bertholdia* (*Trichromia*) *specularis* H. S.; *Halesidota trigona* Grote belongs to the same genus. *Trichromia* Hübn., has *onytes* Cr., as type of the genus and *Veritos* Walk., will become a synonym of *Trichromia* Hübn. *Specularis* has little in common with *Zatrephes* where the species has been placed by Mr. Kirby.

Bertholdia albipuncta, sp. nov.

Head brown, palpi white. Collar brown finely edged with white and with a large white central spot. Thorax brown. Abdomen dorsally red; ventrally white; a lateral row of black spots. Primaries above brown minutely specked with black;

a small white spot on the submedian vein at a third from the base; a large subapical vitreous space, on the costal margin, posteriorly shaded with lilacine; the veins crossing this space flecked with dark brown; a whitish marginal line. Secondaries white; at the base pinkish. Underneath the base of the primaries shaded with red. Expanse, 33 mm.

Habitat: Mexico to Brazil.

Easily distinguished from *B. specularis* H. S. and *B. trigona* Grote by the white spot on the collar and the marginal white line.

Lophocampa andensis, sp. nov.

Head brown; frons whitish. Thorax brown, the collar and patagiæ edged with white. Abdomen brown. Primaries brown flecked with yellowish scales and with four transverse rows of large white spots, the second row bifurcate from the median vein to the costal margin; fringe brown spotted with white. Secondaries white; a brown spot at the apex. Expanse, ♂ 40 mm.

Habitat: U. S. Colombia.

I consider the following species as belonging to the genus *Lophocampa* Harris; *caryæ* Harr., *propinquens* Hy. Edw., *bicolor* Walk., *agassizii* Pack., *maculata* Harr., and *courregesi* Dogn. The following species have two or three costal spurs on the secondaries; *subalpina* French, *albigutta* Bdv., *ambigua* Strk.; *minima* Neum., has veins 3, 4 and 5, on the secondaries from a point; *sobrina* Stretch and *lugens* Hy. Edw have veins 4 and 5 stalked on the secondaries and two costal spurs.

Edwardsi Pack. and *labecula* Grote seem intermediate between *Lophocampa* and *Halisidota*. My observations have reference only to those species which I possess.

Halisidota typical will include *tesselaris* A. & S., with its forms *interlineata* Walk., *cinctipes* Grote and *atra* Druce, also several species described under *Phægoptera*, such as *daraba* Druce, *ergana* Dogn., *aconia* H. S., and *thalassina* H. S. Many of the species placed under *Halisidota* will require new genera, including the following species, which I describe under that genus until I can obtain more material.

Halisidota pulverea, sp. nov.

Body chrome yellow. Primaries chrome yellow thickly covered with dark striæ and specks, confluent in places and forming an indistinct basal and outer line; a submarginal row of blackish points; a large black point at the end of the cell. Secondaries yellow, a small brown submarginal spot between veins 5 and 6. Underneath whitish yellow; some brownish striæ on the costal and outer margins of the primaries. Expanse, ♂ 42 mm.

Habitat: São Paulo, S. E. Brazil.

Belongs to the same group as *strigulosa* Walk., *mandus* H. S.,

oruba Schs.; veins 7–10 on primaries stalked and secondaries with veins 3 and 4 more or less stalked and vein 8 short. *H. strigulosa* varies, the Brazilian specimens agreeing with the neuration of this group, but Mexican specimens have vein 10 from the cell, thus connecting it with the group of *alsus* Cr., *atomaria* Walk., *pectinata* Schs., *catenulata* Hübn and *laroipa* Druce.

Halisidota margona, sp. nov.

Body chrome yellow, the patagiæ inwardly shaded with brown. Primaries acute with outer margin straight and oblique; yellow, the inner margin dark brown; fine wavy brown lines cross the wings, very indistinct at the base; the outer and submarginal lines double, filled in with a slightly darker shade than the ground color, and the submarginal line ceases at vein 5; a terminal row of darker spots edged with brownish between the veins; a dark spot at the end of the cell. Secondaries whitish yellow. Expanse, 52 mm.

Habitat: Jalapa, Mexico.

Allied to *H. strigulosa* Walk.

Halisidota quanta, sp. nov.

Head and thorax chrome yellow, the collar finely edged with brown. Abdomen buff above, whitish underneath. Primaries chrome yellow with transverse darker lunular shades and a broad dark gray streak from the base to just below the apex. Secondaries white. Underneath yellowish white. Expanse, 38 mm.

Habitat: Castro, Parana.

Neuration agrees with Mexican specimens of *H. strigulosa* Walk.

Halisidota rosetta, sp. nov.

Head and collar dark buff; thorax paler. Abdomen pink above; underneath buff with three gray streaks. Primaries yellow with some indistinct fine lunular streaks, especially towards the outer margin; a fine dark brown line along the median nervure to vein 4; a short black streak between veins 5 and 6; a submarginal row of minute dark spots. Secondaries white. Expanse, 43 mm.

Habitat: São Paulo, S. E. Brazil.

Neuration agrees with *H. quanta* Schs.

Halisidota pectina, sp. nov.

Antennæ very deeply pectinated in the ♂. Head and thorax dark buff; two black points on the collar and two on each patagia. Body chrome yellow. Primaries yellow with a broad basal and median transverse grayish shade; a double terminal and subterminal fine dark wavy line, the space within filled with a darker shade; the fringe yellowish with some black spots. Secondaries yellow. Expanse, ♂ 41 mm.

Habitat: Jalapa, Mexico.

Allied to what I have as *alsus* Cr., though I am doubtful about the identification, having no Surinam specimens and Cramer's figure being rather poor.

Halisidota thyophora, sp. nov.

Body yellowish buff; two minute dark points on the collar. Primaries pale yellow, somewhat diaphanous, the costal and inner margin yellower; three basal, two median, three outer and three terminal, fine, irregular transverse lines, the median and outer lines becoming confluent on the inner margin; on the costal margin some black points indicate the lines and there is a submarginal black point between veins 5 and 6; some dark points on the fringe. Secondaries yellowish white. Expanse, 38 mm.

Habitat: Aroa, Venezuela.

I have used a Mss. name of Moritz on a specimen in the Saunders collection at Oxford. This species is allied to *H. œnone* Butl., with which it agrees in neuration. Both are allied to *texta* H. S. in neuration, but vein 8 is sometimes present as a short spur on the secondaries, whereas all my specimens of *texta* are without it.

Euhalisidota sablona, sp. nov.

♀ Body fawn color. Primaries fawn color with some buff spots at the base, along the costa, in the cell and a subterminal row; a few minute black scales scattered over the wing. Secondaries pale buff, the outer margin broadly and irregularly powdered with dark scales. Expanse, 58 mm.

Habitat: São Paulo, S. E. Brazil.

Phægoptera nexoides, sp. nov.

Differs from *P. nexa* H. S., in the greater extension of the brown on the primaries, leaving only a basal white spot, a faint white median shade and a subterminal white band. The collar has no white spots, but the patagiæ are broadly bordered with white dorsally. The secondaries are yellowish white with the veins and a narrow marginal shade dark gray. Expanse, 55 mm.

Habitat: São Paulo, S. E. Brazil.

Phægoptera chorima, sp. nov.

Head and thorax black; the collar posteriorly reddish; a dorsal red spot on the thorax and a reddish point on the patagiæ; abdomen dorsally red; a large black subdorsal spot near the base; beneath black with a lateral row of red spots. Coxæ red. Primaries grayish brown with darker shades; a basal dark yellow band edged with black, forming an angle on the median nervure and not reaching the inner margin; a yellow spot edged with black in the cell and connected by a black shade with the costal margin; an outer row of contiguous triangular spots bordered with black; some subterminal and terminal spots similarly colored but small. Secondaries smoky brown with some yellowish spots on the outer margin towards the apex. Expanse, 72 mm.

Habitat: São Paulo, S. E. Brazil.

A very close ally of *P. fumosa* Butl.

Phægoptera rizoma, sp. nov.

Head black, frons with two white spots. Collar black with a lateral white

streak. Thorax reddish, broadly brown subdorsally; patagiæ brown with a broad white streak. Abdomen red above with a subdorsal black streak; some transverse black streaks posteriorly; a row of black spots laterally; underneath black with two white streaks. Primaries black; a broad white curved band from the base of the costal margin to the apex; two small white marginal spots between veins 2 and 3, and 3 and 4. Secondaries dull blackish brown; a broad white streak at the base and some white spots near the apex. Expanse, 40 mm.

Habitat: São Paulo, S. E. Brazil.

Phægoptera ? aurogutta, sp. nov.

Palpi, head, and thorax black, the latter with a large crimson tuft posteriorly. Abdomen black with some yellow transverse lines posteriorly. Primaries greyish black with golden yellow spots; six on the costa; three in the cell, and two at the end of the cell; one between veins 7 and 8; two between veins 6 and 7; the same between 5 and 6, 6 and 4, and 4 and 3; three between veins 2 and 3; eight between the median and submedian; one on the inner margin near the angle; eight spots on the fringe. Secondaries light brown; a dark spot in the cell; the apex black, and some diffuse blackish shades along the outer margin; the fringe yellow. Expanse, 40 mm.

Habitat: U. S. Colombia.

Mazæras francki, sp. nov.

Head and collar dark red, the latter with two black points. Thorax dark reddish brown. Abdomen red at the base, otherwise yellow above with a subdorsal and a lateral row of large black spots. Primaries above dark reddish brown with a pink spot on the inner margin at the base. Secondaries pinkish white, the veins, fringe and inner margin broadly pink. Underneath the disc and inner margin of the primaries pink. Expanse, 60 mm.

Habitat: São Paulo, S. E. Brazil.

Allied to *M. conferta* Walk.

Mazæras rusca, sp. nov.

Head and thorax vermilion red, the patagiæ with two brownish streaks. Abdomen yellow with a dorsal and a lateral row of small black spots. Primaries vermilion red, the veins gray; fine grayish striæ form an indistinct outer and a subterminal band. Secondaries pink with the disc yellowish white. Underneath the primaries are red; the apex and outer margin brownish. Expanse, 44 mm.

Habitat: São Paulo, S. E. Brazil.

Chætoloma dissimilis, sp. nov.

Palpi black. Head and thorax buff. Abdomen orange with a large dorsal spot of dark metallic blue. ♂. Primaries hyaline, the costal and inner margins buff, the former with three blue black marks, the latter with a dark upright line beyond the center. Secondaries hyaline, the costal and inner margins orange.

♀. Primaries yellowish brown, darkest on the inner and outer margins; two small black marks on the costa and a line on the inner margin as in the male and

reaching vein 2. Secondaries orange with a broad blue black mark from the anal angle to vein 3. Expanse, ♂ 41 mm., ♀ 55 mm.

Habitat: U. S. Colombia.

Apparently allied to *Chætoloma actinobola* Feld.

Palustra sericea, sp. nov.

Head, thorax, and abdomen underneath brown; abdomen above chrome yellow Primaries brown. Secondaries grayish brown, whitish at the base. Underneath the base of the costal margin chrome yellow, the disc towards the base whitish. Expanse. ♀ 53 mm.

Habitat: Castro, Parana.

Motada dukinfieldia, sp. nov.

Head and thorax brownish gray. Abdomen yellowish above with a subdorsal row of black spots; underneath brown with transverse yellow bands. Wings brownish gray, all the veins broadly creamy yellow; the fringe creamy yellow. Expanse, ♀ 60 mm.

Habitat: Castro, Parana.

Motada bergi, sp, nov.

Head and thorax brown. Abdomen brown with a broad lateral yellowish band. Wings brown, the veins on the primaries distinctly paler; the discocellulars darker. Expanse, ♂ 37 mm., ♀ 42 mm.

Habitat: Castro, Parana.

Motada honora, sp. nov.

Head and thorax dark brown, the patagiæ with some golden hairs. Abdomen, above and anus golden yellow with some indistinct narrow, black, transverse bands; Underneath darker brown. Primaries rich brown with the veins darker. Secondaries light brown with some golden hairs at the base. Expanse, ♀ 40 mm.

Habitat: Castro, Parana.

Motada paula, sp. nov.

Body brownish gray, the abdomen paler than the thorax. Primaries fawn color with a black point at the end of the cell. Secondaries white, the margins narrowly fawn color. Expanse, ♂ 30 mm., ♀ 39 mm.

Habitat: Castro, Parana.

Motada amaryllis, sp. nov.

Head and thorax light reddish brown. Abdomen black with yellow transverse bands, concealed however by the long pale fawn color hairs which cover the body. Primaries pale fawn color, the fringe whitish. Secondaries whitish with tinged fawn color. Expanse, ♂ 30 mm.

Habitat: Castro, Parana.

What I believe to be the ♀ of this species is entirely yellow without any marking. Expanse, 38 mm.

Motada variegata, sp. nov.

Head black. Collar yellow. Abdomen black with a pale lateral band. Primaries dark brown, the veins on the outer half finely white; two small white spots in the cell connected by a blackish streak, a large round black spot at the end of the cell; some irregular white markings on the inner margin; a fine, indistinct and interrupted whitish outer line; a submarginal wavy white shade. Secondaries white; a dark spot in the cell; some irregular dark blotches along the outer margin. Expanse, 43 mm.

Habitat: São Paulo, S. E. Brazil.

Some specimens of this species are very much darker.

Titya lanuginosa, sp. nov.

Body of grayish brown; the anal segment silvery gray. Wings grayish brown: the primaries with a basal dark shade from the costa to the submedian; a velvety black spot in the cell; an outer wavy transverse dark shade, outwardly bordered with paler gray. Expanse, ♀ 67 mm.

Habitat: São Paulo, S. E. Brazil.

Hydrias amaryllis, sp. nov.

Body bright yellow. Wings bright yellow, the veins darker on the yellow portion; two broad transverse straight gray bands, edged on either side with white, the basal band indistinct on the secondaries; the outer band from near the apex of the primaries to the anal angle of the secondaries. Expanse, ♂ 37 mm.

Habitat: Castro, Parana.

Hydrias vitripuncta, sp. nov.

Body reddish brown. Primaries reddish brown, the basal half darker, limited by a fine pale line, oblique from the costa, then curving inwardly towards the inner margin; a subterminal row of whitish lunular marks; a terminal yellowish line; on the fringe grayish lunules. Secondaries reddish brown; a submarginal row of whitish hyaline spots, the third from the apex being the largest and is placed just beyond the cell. Expanse, ♂ 30 mm.

Habitat: Aroa, Venezuela.

Hydrias marna, sp. nov.

Head and thorax violaceous gray. Abdomen lilacine brown. Primaries fawn color thickly speckled with dark brown scales; the base, inner margin and half of the outer margin above the inner angle, lilacine gray; an outer yellowish transverse line; the apical portion of the outer margin whitish; a subterminal row of fawn color quadrate spots; the extreme margin fawn color. Secondaries reddish brown; the costal margin paler with dark specks: a transverse median and a subterminal whitish line. Expanse, 28 mm.

Habitat: São Paulo, S. E. Brazil.

Hydrias venalia, sp. nov.

Body fawn color. Primaries reddish fawn color, darker at the base and limited by a double irregular dark gray line; a small dark gray spot on the costa at the base;

a black point in the cell; an outer wavy gray line exteriorly shaded with white followed by an indistinct grayish line; a subterminal row of gray spots. Secondaries white; the costal margin reddish fawn color with the commencement of transverse gray lines. Expanse, 29 mm.

Habitat: Aroa, Venezuela.

Hydrias chera, sp. nov.

Body brownish gray. Primaries brownish gray, dark at the base; a brown point in the cell; an outer, wavy dark gray line; a subterminal irregular dark line; the lines heaviest on the costal margin. Secondaries brown; the costa and apex broadly gray; a median and a submarginal wavy dark line. Expanse, ♂ 41 mm.

Habitat: São Paulo, S. E. Brazil.

Hydrias funerea, sp. nov.

Head and thorax dark gray speckled with white; abdomen brown. Primaries and costal margin of secondaries finely and thickly mottled gray and dark brown; an indistinct trace of a basal, median, outer and subterminal dark transverse shade, secondaries otherwise brown. Wings underneath brown. Expanse, 47 mm.

Habitat: São Paulo, S. E. Brazil.

Hydrias mediana, sp. nov.

Head and thorax grayish. Abdomen brown. Primaries brown, the median space whitish limited on either side by a grayish shade; a small dark spot at the base; a subterminal dark wavy line. Secondaries brown; the costal margin broadly whitish with traces of a median and subterminal dark shade. Expanse, 31 mm.

Habitat: Rio Janeiro.

Hydrias chamicuros, sp. nov.

Body and wings brown; on the primaries a large white spot on the middle of the costal margin, and a similar spot on the inner margin; an indistinct outer and terminal dark shade. Secondaries with the trace of three broad white lines on the half of the costal margin. Expanse, 27 mm.

Habitat: Peruvian Amazons.

Hydrias boresa, sp. nov.

Body fawn color. Primaries fawn color, shaded with smoky black, especially in the disc and broadly along the costa; the veins on the outer half of the wing reddish brown; a subterminal wavy, smoky black shade. Secondaries pale fawn color, the inner margin with brownish hairs; a large dusky black space at the apex sending a subterminal smoky shade towards the anal angle. Expanse, ♂ 22 mm.

Habitat: Aroa, Venezuela.

Ocha drucei, sp. nov.

Body creamy white. Primaries pale fawn color, whitish along the inner margin; a double wavy brown basal line; two minute black points in the cell, one above the other; two outer wavy brownish lines; some submarginal brownish shades at the

apex and middle of the outer margin; fringe spotted with brown. Secondaries creamy yellow; some brownish shades on the costal margin. Expanse, 23 mm.

Habitat: São Paulo, S. E. Brazil.

Macromphalia arpia, sp. nov.

♂. Body brown. Primaries brown, the outer half indistinctly shaded with gray; a dark brown spot in the cell. Secondaries grayish brown, with a darker median line and indistinct broad submarginal shade.

♀. Anal segment dark silky gray. The wings uniform brown with a dark spot in the cell on the primaries. Expanse, ♂ 31 mm., ♀ 52 mm.

Habitat: Buenos Ayres.

Artace manoba, sp. nov.

Head, and patagiæ white; thorax and abdomen gray with long white hairs at the base of the latter. Primaries white; a broad gray shade from the middle of the inner margin to the apex, where it is cut by a white line; the extreme outer margin finely gray. Secondaries white, the extreme margin gray. Expanse, 30 mm.

Habitat: Aroa, Venezuela.

DESCRIPTIONS OF TWO NOCTUID LARVÆ.

By HARRISON G. DYAR.

Spargaloma sexpunctata *Grote.*

Head small, pale yellowish testaceous, ocelli black; width, 1.8 mm. Body slender, cylindrical, green; feet all about alike, the anal pair divergent. Tubercles concolorous setæ moderately long, single, white, normal in arrangement for the Noctuidæ, iii rather close to the spiracle, iv substigmatal, posterior; three setæ on the leg plate. The larva is without marks, though the tracheal line may be seen with a lens. The last three stages were observed with widths of head .8, 1.15 and 1.8 mm.

Resembles the larva of *Sarrothripa*, but the setæ are shorter and it spins no web. Solitary on the Dogbane (*Apocynum*).

Deva purpurigera *Walker.*

Head small, green with black ocelli; width, 1.5 mm. Body slightly enlarged on joints 5, 6, 7 and 12; tubercles low rounded cones on the prominent segments, the segmental incisures deep, the segments rounded, so that the larva appears more humped and angled than is actually the case. Color translucent green, not yellowish, marked with bright opaque white, in the semblance of oblique transverse bands. On the thorax the white stigmatal band is still intact, though cut down at the incisures; behind on the abdomen it is cut through at these points and produced subventrally; the subdorsal band is obliquely divided between tubercles i and ii, the hinder portion joining the stigmatal white patch centrally on each segment. The bands unite confusedly with a narrow geminate dorsal line. Feet only present on joints, 9, 10 and 13, reddish tipped; thoracic feet green. Tubercles normal for the Noctuidæ, iii, especially on joints 5 and 6, shining black. It was regarded at first as the egg of a parasite, till it was noticed that it was alike on both sides. Tubercle vii consists of three rather distant setæ on joints 5 to 8. Length about 30 mm.

Solitary on Meadow-Rue (*Thalictrum*), towards the end of May. Green and white, curiously hunched up.

DESCRIPTION OF A NEW MOTH.

BY WILLIAM BEUTENMÜLLER.

Ottolenguia, gen. nov.

Primaries.—Vein 1 free; median four-branched; veins 6–10 all simple, unbranched; veins 11 from the subcostal near the middle of the cell; vein 12 from base.

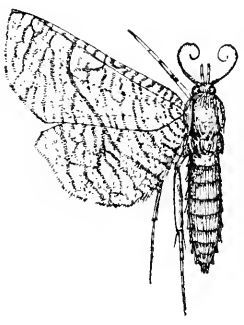
Secondaries.—Two internal veins; median vein four-branched; veins 6–7 from apex of cell; vein 8 from base, sinuate and close to 7 at the outer part of the cell. A distinct frenulum hooked into a loop on the subcostal vein of the primaries.

Antennæ strongly pectinated in the male, simple in the female; palpi from 2 to 3 mm. long, with short scales; eyes rather large, naked; tongue very short. Body long and slender, extending much beyond the hind wings. Fore wings elongated, much longer than broad; costa somewhat sinuate at the middle in the male, apex acute; hind angles obliquely rounded; outer margin entire. Hind wings extending to the hind angle of the fore wings, outer margin sinuate above the middle, apex acute, hind angle rounded, costa somewhat sinuate at the middle. Legs slender, closely scaled; middle tibiæ with one pair of spurs; hind tibiæ with two pairs.

Ottolenguia reticulina, sp. nov.

Wings above and below pale cinnamon brown, with numerous fine reticulations of a darker color, and with transverse irregularly angled lines. The line on the middle of the fore wing is bifurcate from the end of the cell to the costa. Head, thorax, abdomen and legs pale cinnamon brown. Expanse, ♂ 25 mm.; ♀ 33 mm.

Habitat: Flamingo, Florida (Coll. R. Ottolengui); Riverside, California (Coll. A. Bolter).



An example of this species from Florida was in Hy. Edward's collection for a number of years awaiting identification. Mr. Edwards did not describe the specimen, not knowing where to place it generically. The insect was also seen by a number of well-known Lepidopterists who likewise were unable to recognize it, or place it generically. This specimen unfortunately got broken beyond repair.

In looking over Dr. R. Ottolengui's collection recently I discovered a female of the same species, and another male specimen was sent to Mr. Dyar by Mr. Bolter for naming. The species is certainly a very perplexing one, as regards its position in classification. It does not seem to fit in any of the families of Lepidoptera, except the Thyrididæ near the Indian genus *Herdonia* (see Hampson, Moths of India, Vol. I, p. 367, fig. 248). I am under obligation to Mr. Dyar for a study of the venation of the genus. The figure is twice natural size.

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NEW SPECIES OF HETEROCERA FROM TROPICAL AMERICA.

By W. Schaus.

CASTNIIDÆ.

Castnia gramivora, sp. nov.

Body light brown above, whitish underneath; the patagiæ iridescent olivaceous green. Primaries light brown, somewhat olivaceous at the base and along the inner margin; on the outer half of the wing a large semi-diaphanous space, not reaching the margins and crossed by brown veins, also interrupted anteriorly by a large brown spot extending from the costal margin. Secondaries brown, reddish at the base; a terminal row of reddish brown spots on the outer margin, preceded by a large semi-diaphanous space. Underneath the wings are much paler. Expanse, 64 mm.

Habitat: São Paulo, S. E. Brazil.

This species was discovered by E. D. Jones, Esq., who tells me that it is found flying in the grasses after the manner of certain Noctuidæ.

Castnia corrupta, sp. nov.

Entirely dark brown, changing to dark metallic green in certain lights; the anus orange red. At the anal angle of the secondaries a red spot adjoining some creamy white clusters of scales which extend towards the center of the wing. Underneath the wings are powdered with reddish scales, forming an indistinct terminal band on the primaries and two more distinct bands on the secondaries. Expanse, 110 mm.

Habitat: Colombia.

Castnia veraguana *Ww.*

Castnia veraguana Westwood, Trans. Linn. Soc. London, Ser. 2, Zool. I, p. 168, pl. 30, fig. 1; Druce, Biol. Centr. Amer. Het. p. 24, pl. 14, fig. 4.

I have recently obtained what I believe to be the ♂ of the above species. The primaries agree very well with the type figured, only the subapical white spots are more oblique in my specimens. The secondaries differ in being velvety black with a marginal row of large red spots extending on to the fringe. Expanse, 108–130 mm.

Habitat: Colombia.

Should my description refer to a new species then I propose for it the name of *C. govara*.

AGARISTIDÆ.

Arpia, gen. nov.

Palpi short, porrect, pubescent. Antennæ long, filiform. Primaries straight on the costal margin and inner margin; the outer margin oblique in the ♂, slightly convex in the ♀; vein 6 from upper angle of cell; veins 7, 8, 9, from a point at end of small areolet. Secondaries with the neuration as in *Copidyras*, from which this genus differs chiefly in the arrangement of veins 7, 8, 9, on the primaries.

Arpia janeira, sp. nov.

Head, thorax, and abdomen dark grey; patagiæ reddish brown. Primaries with the costa broadly greyish fawn color, separated from the outer and posterior portion of the wing, which is dark brown, by a fine white line which starts from the costa near the apex, descends obliquely below vein 4, curves upwards into the end of the cell, again descends obliquely, nearly touching a large dark brown spot, oval in shape, which occupies the base of the inner margin, and then recedes to the inner margin near the angle. Secondaries yellow with a broad black margin. Underneath yellow; the secondaries margined with dark brown; the primaries with the costa narrowly, the apex broadly brown, and a transverse broad brown band from the costa to the inner margin near the angle. Expanse, 42 mm.

Habitat: Rio Janeiro.

Phasis meridiana, sp. nov.

Head and thorax black. Abdomen yellow with a subdorsal and a lateral yellow line. Primaries black with a creamy yellow oblique band beyond the cell from the subcostal to vein 2. Secondaries bright yellow with all the margins very broadly black, limiting the yellow to a very small space. Underneath the yellow band on the primaries is wider. Expanse, 48 mm.

Habitat: Rio Paranapanema, S. Brazil.

LITHOSIIDÆ.

Mæpha coresa, sp. nov.

Head black. Collar and patagiæ golden yellow. Thorax dark grey, abdomen yellow. Primaries: basal half golden brown including a large golden yellow space from the base; beyond golden yellow with a bright carmine spot; the outer margis broadly golden brown advancing inwardly about the center and touching the carmine spot. Secondaries orange red with the fringe brown. Underneath primaries orange with the apex and outer margin brown; the secondaries yellow. Expanse, 15 mm.

Habitat: São Paulo, S. E. Brazil.

Talara rosacea, sp. nov.

Head grey, posteriorly red; collar grey, laterally red; thorax dark grey; abdomen grey, the base and anus red. Primaries pink, the inner margin broadly dark grey. Secondaries red. Underneath red, the inner margin on the primaries narrowly grey. Expanse, 17 mm.

Habitat: São Paulo, S. E. Brazil.

Talara grisea, sp. nov.

Head and thorax grey; abdomen red. Primaries dark grey. Secondaries white; the apex and outer margin greyish. Underneath the same. Expanse, 18 mm.

Habitat: São Paulo, S. E. Brazil.

Talara ruficollis, sp. nov.

Head and body greyish black, collar reddish. Primaries greyish black. Secondaries dull black. Expanse 18 mm.

Habitat: São Paulo, S. E. Brazil.

Talara domina, sp. nov.

Head and thorax dark grey. Collar and abdomen red. Primaries dark grey. Secondaries brownish grey. Expanse, 17 mm.

Habitat: São Paulo, S. E. Brazil.

Talara barema, sp. nov.

Head and thorax light grey. Abdomen pale yellow. Primaries light grey speckled with brown scales; a cluster of dark scales about the middle of the wing. Secondaries pale yellow. Underneath pale yellow, the disc and costa of the primaries brownish. Expanse, 16 mm.

Habitat: São Paulo, S. E. Brazil.

Talara obscura, sp. nov.

Body black. Primaries glossy black with a faint greenish tinge. Secondaries dark brown. Expanse, 17 mm.

Habitat: São Paulo, Rio Janeiro.

Talara bombycia, sp. nov.

Body greyish brown. Primaries light grey, shaded with brown at the base, along the costa and on the outer margin near the apex and inner angle; a dentate white line crosses the wing at a third from the base, and there is a curved white line beyond the cell from the costal to the inner margin. Secondaries smoky brown. Expanse, 17 mm.

Habitat: São Paulo, S. E. Brazil.

Odozana varda, sp. nov.

Head and thorax blackish. Abdomen red. Primaries dark brown glossed with violet. Secondaries with the base red to the anal angle; the apical portion and outer margin black. Expanse, 20 mm.

Habitat: São Paulo, S. E. Brazil.

Odozana olivacea, sp. nov.

Head and thorax brownish green. Collar yellow. Abdomen red. Primaries glossy, olivaceous green. Secondaries red; the costal and outer margins narrowly black, the apex broadly black. Underneath the primaries are black. Expanse, 20 mm.

Habitat: São Paulo, S. E. Brazil.

Odozana pascuala, sp. nov.

Head and thorax brownish grey. Collar yellow. Abdomen orange red. Primaries brownish grey. Secondaries crimson, the costal margin yellowish, the outer margin black, the median vein black. Underneath primaries black, the costal half at the base red. Secondaries orange with black outer margin. Expanse, 18 mm.

Habitat: São Paulo, S. E. Brazil.

Odozana cuprea, sp. nov.

Head black. Thorax coppery brown. Abdomen with the basal half fawn color, the anal half red. Primaries coppery brown. Secondaries pale reddish yellow, a large brownish space at the apex. Expanse, 22 mm.

Habitat. São Paulo, S. E. Brazil.

Odozana margina, sp. nov.

Head and thorax grey. Collar and patagiæ dorsally red. Abdomen red. Primaries glossy brown, the inner margin yellow. Secondaries red, the outer margin black. Expanse, 16 mm.

Habitat: São Paulo, S. E. Brazil.

Nodoza, gen. nov.

Differs from *Odozana* in having the ♂ antennæ deeply pectinated and the anal angle of the secondaries much prolonged.

Nodoza tristis, sp. nov.

Head, thorax and primaries chocolate brown. Abdomen blackish. Secondaries brown, slightly hyaline at the base; a dark spot at the end of the cell. Expanse, 22 mm.

Habitat: São Paulo, S. E. Brazil.

Zonoda, gen. nov.

Allied to *Odozana*, but the ♂ has a large tuft of hairs on the inner margin of the primaries underneath, and the secondaries have very long tufts of hairs on the inner margin, which is cleft and very prolonged.

Zanoda fasciata, sp. nov.

Head and thorax brown. Collar and patagiæ yellow. Abdomen yellow. Primaries light glossy brown; a yellow oval spot at the base of the inner margin; a broad yellow median band, sometimes divided and leaving a costal spot and one on the inner margin. Secondaries yellow, the apex and fringe black. Expanse, 23 mm.

Habitat: São Paulo, S. E. Brazil.

Zanoda dives, sp. nov.

Head and thorax coppery brown. Collar yellow. Abdomen red. Primaries coppery brown with a median transverse yellow band. Secondaries red; costal margin white, outer margin black. Expanse, 18 mm.

Habitat: São Paulo, S. E. Brazil.

Trichomelia placida, sp. nov.

Body dark grey. Primaries pale grey, all the veins finely dark. A quadrate dark spot in the cell and an outer transverse dark irregular line. Secondaries pale grey. Expanse, 22 mm.

Habitat: Castro Parana.

Allied to *T. celenna* Schs, but the secondaries much paler and the markings on the primaries different.

Trichomelia parima, sp. nov.

Dark smoky grey, the veins on the primaries finely brown; an indistinct median shade on the primaries widest on the inner margin. Expanse, 25 mm.

Habitat: São Paulo, S. E. Brazil.

Illice subfulgens, sp. nov.

Head and thorax creamy yellow. Abdomen grey. Primaries light brown iridescent; the inner margin, half of the outer margin above the angle, and a broad median shade creamy white. Secondaries grey whitish at the base. Underneath dark grey, the base of the secondaries white. Expanse, 28 mm.

Habitat: São Paulo, S. E. Brazil.

Lithosia sadima, sp. nov.

Body grey. Primaries above light silky grey, the costal margin faintly yellowish. Secondaries grey, fawn color at the base and broadly along the inner margin. Underneath blackish grey, the inner half of the secondaries fawn color. Expanse, 28 mm.

Habitat: Castro Parana.

Crambidia parvita, sp. nov.

Entirely pure dull white. Expanse, 18 mm.

Habitat: São Paulo, S. E. Brazil.

NOLINÆ.

Calligenia marmorata, sp. nov.

Head and collar white. Thorax and abdomen fawn color. Primaries white; a transverse brown line at the base, then a lunular steel grey spot connected with the costal margin by a brown spot; a third brown spot from the costal margin to the cell; on the inner margin a large oval brown spot anteriorly shaded with grey; two brown blotches above the outer portion of the oval spot and between it and the costal margin; a subterminal brown band and a minute brown spot on the apex. Secondaries white, with a narrow brown outer margin. Expanse, 17 mm.

Habitat: Castro Parana.

Calligenia erminea, sp. nov.

Body white. Primaries white; an indistinct brownish median line; four minute dark spots on the costa; from the inner angle to below the apex on the outer margin a lunate spot, mottled grey and white; on the extreme outer margin some

minute brown spots. Secondaries white, the outer margin black. Underneath white; on the primaries a broad subterminal blackish shade, projecting about its center to the outer margin; the costa smoky. Secondaries with a black outer margin. Expanse, 14 mm.

Habitat: São Paulo, S. E. Brazil.

Nola panthera, sp. nov.

Head and thorax white. Abdomen grey. Primaries white with four rows of small black spots; a black spot in the cell between rows 2 and 3, and another between rows 3 and 4. Three submarginal spots, one on the costa, one near the inner angle and another about the middle of the outer margin; a terminal row of black points. Secondaries whitish, slightly grey along the outer margin. Expanse, 20 mm.

Habitat: São Paulo, S. E. Brazil.

Nola hermana, sp. nov.

Head brown. Collar grey edged with brown. Abdomen grey. Primaries grey; a large triangular brown space occupying the basal half of the costal margin; a double outer fine black line, forming a prolonged curve at veins 3 and 4; the grey portion of the wing minutely speckled with brown. Secondaries pale brownish grey. Expanse, ♀ 23 mm.

Habitat: São Paulo, S. E. Brazil.

Allied to *N. ternulosa* Druce.

Nola rodea, sp. nov.

Head and thorax grey. Abdomen pale brown. Primaries grey; a brown spot on the costa at the base and a broad median brown shade from the costa to the inner margin; a fine blackish basal and outer line; a subterminal dark grey shade and some minute brown terminal spots. Secondaries whitish, the apex broadly grey. Expanse, 22 mm.

Habitat: São Paulo, S. E. Brazil.

Nola garuba, sp. nov.

Head and thorax light grey. Abdomen pale brown. Primaries whitish; on the costa, a basal and a median dark brown spot; a fine dark curved outer line, most distinctly marked on the inner margin; a subterminal and a terminal grey shade. Secondaries greyish brown. Expanse, 20 mm.

Habitat: Castro, Parana.

Allied to *N. sexmaculata* Grote.

Nola divisa, sp. nov.

Body cream color. Primaries with the basal half creamy white, shaded with brown; three round tufts of raised scales in the cell; outer half grey, thickly speckled with black, so the outer and subterminal lines are very indistinct; the apex tinged with white. Secondaries white. Expanse, 19 mm.

Habitat: Castro, Parana.

Nola arana, sp. nov.

Head white, frons brown. Collar and thorax pale brown speckled with black and dark brown scales. Abdomen light brown. Primaries fawn color speckled with

yellowish scales; the costa also speckled with black and dark green scales; near the base of the cell a large cluster of greenish black scales and an oblique mark of similar scales from the costa subapically; the apex whitish; two round tufts of raised scales in the cell; a faint submarginal brownish shade. Secondaries greyish brown; a minute spot in the cell. Expanse, 22 mm.

Habitat: São Paulo, S. E. Brazil.

Nola natama, sp. nov.

Head and thorax white. Abdomen cream color. Primaries white on the basal half and at the apex; some olive shadings along the costa; the outer line formed of minute clusters of velvety black scales, heavily shaded on either side with brown and yellowish scales. Secondaries dark grey. Expanse, 18 mm.

Habitat: São Paulo, S. E. Brazil.

Nola solvita, sp. nov.

Body dark grey. Primaries whitish grey, thickly speckled with brown and black scales, giving the wings a dark appearance; an indistinct basal and outer line; a faint median shade and another, subterminal; fringe brown. Secondaries smoky grey. Expanse, 17 mm.

Habitat: Castro Parana.

LYMANTRIIDÆ.

Orgyia falcata, sp. nov.

Body grey. Primaries with the basal third brownish grey, limited by a wavy dark brown line and crossed at the base by a similar line which does not reach the inner margin; the rest of the wing grey with a curved lunular line beyond the cell enclosing toward the costal margin, a large smoky space; at the end of the cell a small brownish spot, a subterminal brown shade streaked with dark brown near the apex; a terminal brown line; fringe pale at the base, dark terminally. Secondaries brownish grey with the fringe as on the primaries. Expanse, 28 mm.

Habitat: Jalapa, Mexico.

This species is allied to *O. leucostigma* S. & A., but the primaries are somewhat produced at the apex.

CYLLOPODIDÆ.

Rhosus unipuncta, sp. nov.

Body dark brown, anus orange. Primaries very dark velvety brown, thinly speckled with greyish scales; a large oblique white spot beyond the cell; fringe light brown. Secondaries dark brown, fringe mottled white and brown. Underneath dark brown, the primaries with a white discal spot and the apex narrowly white; secondaries with two white lines from the base, fringe white. Expanse, 37 mm.

Habitat: São Paulo, S. E. Brazil.

Scotura nervosa, sp. nov.

Head orange; body grey. Primaries grey, all the veins whitish. Secondaries white with all the margins broadly steel grey. Expanse, 30 mm.

Habitat: Aroa, Venezuela.

Allied to *Scotura venata* Butl.

Ephialtias tryma, sp. nov.

Body black above; abdomen underneath white. Legs black above, white underneath. Wings black; on the primaries a broad oblique yellow band on the outer half from the subcostal to the submedian vein. Expanse, 26 mm.

Habitat: Trinidad, B. W. I.

CERATOCAMPIDÆ.

Eacles masoni, sp. nov

Head and collar yellow. Thorax reddish brown. Body yellow, somewhat reddish subdorsally. Primaries yellow, so thickly covered with reddish brown scales and still darker transverse strie, that the yellow is only conspicuous at the apex on the costal margin, and near the inner angle on the outer side of the subterminal line, which is dark, straight and rather closer to the outer margin than in the other described species; the basal line is broad, slightly wavy and hardly apparent in the general dark tone of the wing; in the cell two indistinct dark spots; the outer margin at its center suffused with lilacine scales. Secondaries yellow; a large reddish brown space along the inner margin at the base; the discal spot reddish brown with some central whitish scales; a straight transverse dark line from the apex to the inner margin at two thirds from the base; this line outwardly bordered with yellow chiefly towards the angle; the outer margin otherwise dark reddish brown. Expanse, ♂ 118 mm.

Habitat: Orizaba, Mexico.

It affords me great pleasure to name this fine species after my good friend, J. T. Mason, Esq., of Denver, Colorado, whose discovery of *E. imperialis*, var. *nobilis* was not recognized by Mr. Neumoegen when describing it. I may here mention that I captured in April at Orizaba a fine ♂ of *Eacles Ormondei* Schs., which was originally described from a ♀ specimen. The two sexes scarcely differ.

PSYCHIDÆ.

Oiketicus jonesi, sp. nov.

Entirely lilacine grey without any markings. Expanse, ♂ 42 mm.

Habitat: São Paulo, S. E. Brazil.

NOTES ON THE TRANSFORMATIONS OF THE HIGHER HYMENOPTERA.—I.

BY A. S. PACKARD.

The following descriptions of the larval and pupal stages of some of our more common Hymenoptera belonging to the fossorial families, together with the wasps and bees, were drawn up over twenty years ago and were preserved in the hope of adding others. But lack of time and material has prevented such additions and what few notes have been gathered are now offered for publication. The descriptions are, so far as possible, comparative, as this is especially needful in the case of larvæ whose mode of life is so similar, and which therefore present very slightly marked specific as well as generic characters. In no group of animals, perhaps, are there such slight larval characteristics as in those of the Hymenoptera, the phytophagous forms being excepted. This is evidently due to their living confined in closed cells, to their lack of the necessity or power of locomotion, and to the fact that immediately after birth they can feed on food, whether vegetable, such as pollen, or the bodies of other insects or spiders stored up for them by the prevision of their parents. They live in total darkness, hence are eyeless; they have no enemies to shun, hence have no defensive spines or armature of any kind. The reduction in the limbs and mouth-parts, and the lack of any differentiation in form, ornamentation, or color of the integument; even the undeveloped proctodæum, all tend to prove that the larval forms of these Hymenoptera are due to modifications from simple disuse, for their embryology shows that they have descended from insects whose larval forms were out-of-door feeders, probably like those of the saw-flies, and provided like them with abdominal as well as thoracic legs.

It is to be hoped that our entomologists will hereafter pay more attention to the habits of our wasps and bees, for the wonderful differentiation of the bodies of the adults is correlated with their varied and striking modes of life and their high degree of intelligence.

Pompilus funereus *St. Farg.*

Larva.—This larva is with some hesitation referred to the above species, but it belongs to a common New England species. The head is round, scarcely longer than broad; the surface of the front not very convex, being much shorter and broader than in *Polistes*. Eyes on the

front edge, with a long oblique testaceous line, a little angulated opposite the base of the clypeus. Antennal tubercle situated on the outer edge of a round area opposite the base of the clypeus; supra-clypeal piece obtuse, the suture separating it from the epicranium indistinct. Clypeus transverse, half as long as broad; the sides very oblique, marked by testaceous oblique lines; front edge straight. Labrum broad, being one-third as long as broad; thin, flat, bilobate, overlapping the mandibles, but so thin and expanded that they can be seen through. Mandibles unusually short, stout, thick and broad, not much longer than broad, unidentate, the outer edge produced into a short obtuse point; within curved towards the retreating inner edge. Maxillæ smaller and slenderer than usual, ending in the maxillary palpi, which are short papillæ. Labium as usual, with two papilliform palpi, between which is the rudiment of the lingua, forming a transverse chitinous line. In my two alcoholic specimens the head is bent upon the breast, nearly reaching the middle of the body. The body is very short and broad, dilating in the middle. The end is unusually acute, the lateral region is more prominent, convex and tuberculated than any of the genera of other allied families; much more so than in *Odynerus*. The segments are unusually short, dorsally thickened posteriorly, giving a serrate appearance to the outline of the body, the tip sternally is much exserted and of the same size with the tergite; the two forming a terminal rounded knob.

In its round flattened head bent forward and under the body, the broad transverse clypeus and broad short bilobate thin transparent labrum, and especially the one-toothed, short, broad mandible which differs entirely in form from the other genera previously noticed, we probably have mostly family characters separating the Pompilidæ from the Sphegidæ and Larridæ and other families. It widely differs from the larval *Pelopœus* in its short flattened body and prominent pleurites, and thickened rings generally, but it approaches it in the head-characters, which are the most reliable, in its transverse clypeus and thin bilobate labrum, and in the short mandibles; but they are still much stouter, and the clypeus and labrum are less exserted, while the head is shorter, broader and rounder.

Chalybion cœruleum *(Linn.)*.

Larva.—The specimens occurred at Kelly's Island, Ohio.

Head longer than broad; full convex, with a slight mesial impression; the anterior and inner edge of the eyes marked by a curvilinear

testaceous or chitinous line, opposite and just within the lower end of which are situated the antennal rudiments, situated in a round depression. Supraclypeal piece obscurely marked at the base. Clypeus subtrapezoidal, angular in the middle on each side; twice as broad as long; base and front edge transverse, the front edge slightly concave, exserted so as partially to envelop the base of the mandibles. Labrum very free, exserted and overlapping the mandibles; more than twice as broad as long, bilobate, the corners rounded, the front edge excavated; thin, translucent. Mandibles short, twice as long as broad at base, tridentate, the mesial tooth largest, the inner smallest. Maxillæ rather long and slender. Rudiments of the palpi acute, longer and more pointed than usual. Labium a little wider than usual, the rudiments of the labial palpi acute. Body long cylindrical, the segments of uniform size and shape, not thickened much behind, but still as much so as in the larva of *Megachile*, for instance, and in this respect very different from Crabronid and Pompilid larvæ. The pleural region is not prominent. The body is very cylindrical; the tip broad obtuse, the terminal tergites and sternites broad and flat, together forming an orbicular area, very different from the exserted prominent knob-like ending of the larva of *Pompilus*.

It differs from the larva of *Pompilus* in the short curvilinear testaceous line, in the short broadly trapezoidal clypeus and the distinct exserted labrum. The mandibles differ from those of *Pompilus* in being tridentate and twice as long. The front edges of the segments are thickened, but not so convex as in *Pompilus*, giving a serrate appearance to the body. Tip rounded, full, not nearly so acute as in *Pompilus*. The larvæ of the two genera differ greatly; indeed, more than one would suspect, considering that they are representatives of two allied families.

Pelopæus cementarius (*Drury*) (**flavipes** *Fabr.*).

Pupa.—The pupa of *Pelopæus* differs from that of *Polistes* and *Vespa* in the head being raised more from the pectus. The palpi are visible along their whole length. The legs are much longer, and the pedicel is of the same shape as in the adult. The head is much as in the imago. The mandibles long, slender, curved, covering the base of the maxillæ and lingua. The scape of the antennæ is oblique; the flagellum reaches to the posterior coxæ, resting between the two anterior pairs. The maxillæ are slender, not reaching to the entire labium. Of the rhabdites or blades of the ovipositor, only one pair is visible; the

inner ones are enveloped by the outer pair, which are united into one piece in *Polistes*; above, a small inner pair lies between, slenderer than those beneath. The edges of the abdominal segments are a little more thickened than usual, and slightly spinulose; on the side is a prominent long slender tubercle.

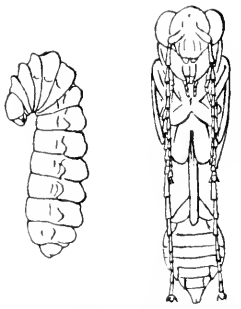

Fig. 1. Larva and pupa of *Pelopæus cementarius*. (Trouvelot del.)

Sphex tibialis St. Farg.

Larva.—The body of the living larva is somewhat flask-shaped, slightly flattened, gradually widening from the head towards the posterior fifth of the body. The head is small and not prominent. There are 13 segments behind the head; the pleural or lateral ridges are rather prominent, those of each segment well defined, the posterior half of each segment much thickened, giving a crenulate outline to the tergum; the last segment is full, orbicular, the end of the abdomen being full.

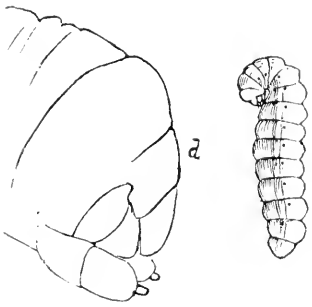

Fig. 2. Larva of *Sphex tibialis*; *a*, side view of head, enlarged. (Trouvelot del.)

Stigmus fraternus *Say*.

Larva.—Body moderately long, slender, cylindrical, tapering slowly towards both extremities; the segments short, very convex, sub-

acutely so, so that dorsally there are subacute extensions of the thickened posterior portion. The terminal segments cylindrical, less convex, the terminal or tenth ring cylindrical, not flattened, large and full. Beneath, the rings are very convex. The pleural region not very distinctly marked. Color a beautiful roseate tint. Head long and as narrow as usual, though no more so; full and convex; supra-clypeal piece large, subtriangular, indistinctly marked. Antennal fossa rudimentary; placed rather farther back, or rather the clypeus is so much shorter than usual as to give it the appearance of being situated farther back. Clypeus short and broad, transversely oblong, base convex, front edge a little concave, as broad as the base; the sides parallel, acutely convex. Labrum large chitinous, transparent, as broad as the clypeus, bilobate, with a distinct median line. Mandibles rather slender, long, incurved, very acute. Maxillæ cylindrical, 2-jointed, tip or rudiment of the palpi minute. Labium much as usual, flattened, cylindrical, ending in a transverse chitinous line, being the rudiment of the lingua? on each side of which are the minute rudiments of the palpi.

Described from living specimens.

Pupa.—Head full, convex in front, much as in the adult; ocelli prominent; papillæ acute. Antennæ folded over the base of the narrow, acute, curved, prominent mandibles as described in *Cemonus*, and reaching to the first pair of trochanters. Lingua much shorter than in *Cemonus*; the palpi very small and slender. The fore legs are very slender, the tarsi just reaching to the middle trochanters, while the hind tarsi reach to the middle of the abdomen. The ovipositor is exserted, the wings covering the middle tibiæ and femora. Length, .15 inch.

It differs from *Cemonus* in generic characters observed in the imago. The palpi are much smaller; lingua and maxillæ much shorter, and mouth-parts generally much weaker. The head is more ovate, full and convex in front, where it is sunken and depressed in *Cemonus*. The antennæ are much slenderer, and the abdomen longer and slenderer, as the hind legs scarcely reach to the middle, where in *Cemonus* they pass beyond. The mandibles are much more slender, their tips being more acute.

Cemonus inornatus (*Say*).

Larva.—Body oblong, long, and greatly flattened, the lateral ridges of that segment very large, broadly triangular, becoming larger and more pointed towards the end of the body. The body does not narrow any until the 11th segment, when it suddenly tapers off. Above,

the rings are broad, slightly convex, in the middle of the body the dorsal arches of the segments are thickened suddenly so as to give a serrate outline to the back when seen laterally; the prominences being largest and most acute on the 4th to 7th segments of the body, counting from the head. The lateral region is very distinctly separated from the dorsal. The prothoracic segment narrow and rounds a little toward the front edge. The head is flattened. Tip of abdomen rounded obtuse, 10th segment small, broad, short, obtuse, not being cylindrical and rounded as usual. Length, .32 inch.

The above are mostly generic characters. Compared with the larva of *Rhopalum* there are great differences. The head is broad and unusually flattened, the rudiments of the eyes are more prominent and conspicuous than before, owing to the flatness of the surface. The supra-clypeal piece is unusually short, broad, flat and triangular. The clypeus is very short, subtrapezoidal. The posterior half is sub-triangular, smooth, and the anterior third is roughened with the edge straight. The labrum is nearly three times as broad as long, slightly bilobate, less so than in *Blepharipus*. The mandibles are large, stout, incurved, unequally bidentate, the inner tooth very distinct, large, dark and chitinous. Maxillæ and labium rather small, cylindrical; palpi acute, as usual.

Its broad flattened head and body, serrate sides and back, and the conspicuously bidentate mandibles and prominent eye-rudiments, as well as the peculiar flattened abdominal tips, will at once distinguish the larvæ of this genus.

The larva lives in irregular burrows like those of *Rhopalum*. All the genera of this group apparently have similar habits, living in loose galleries in the elder and other pithy plants. The larvæ were found, May 14th, in irregular borings in the larger stems of the elder; the galleries were short, not communicating, and were filled with Aphides, whose black carcasses were found remaining in the old burrows, which were over half an inch long and about .12 inch broad.

Pupa.—Front much excavated and depressed, eyes and ocelli very prominent. Antennæ bent angularly over the base of the mandibles so that the scape does not rest flat on the front but is raised at a considerable angle before the base of the flagellum bends over; they reach to the first trochanters, the joints are round, very convex, with broad sutures between. Mandibles very long and prominent, lingua short, not much longer than broad, square at the edge. Maxillæ not distinguishable; maxillary palpi 6-jointed, long and slender, reaching

to fourth joint from end of antennæ. Labial palpi 3-jointed, reaching to fourth joint of maxillary palpi. Legs long and slender, especially the tarsi. Wings long, partially overlapping the middle tibiæ. The hind tarsi reach to beyond the middle of the abdomen. Thorax and abdomen much as in the adult. Ovipositor not retracted. Hind femora and tibiæ folded in the pedicel, between the thorax and abdomen. Length .25 inch.

Passalæcus mandibularis *Cresson.*

Pupa.—♀. The head is much as in *Cemonus*, but the eyes are much narrower. The mandibles are greatly elongated, projecting far beyond the head, the tips meeting but not crossing, as they do in the imago. The antennæ are folded at right angles over the base of the jaws, reaching back to the base of the mesosternum. The maxillæ are very short, merely enclosing the labium whose base is wedged in between them. Both pairs of palpi are shorter and thicker than in *Cemonus*. The labium is distinctly triangular, with the front edge square: the palpi are 4-jointed, the basal joint minute, third longer than the second; fourth nearly twice as long as the third, reaching just beyond the base of the maxillary palpi, the latter reaching to the last joint but two of the antennæ. Wings as in *Cemonus*, though a little shorter. The limbs are arranged much as in *Cemonus:* the forelegs reach to the trochanters of the 2d pair, and the hind tarsi to the middle of the 4th abdominal segment. The abdomen is sessile, regularly ovate, the basal segment being $^2/_3$ as long as broad, as in *Cemonus*, the tip ending in a long slender needle-like mucronate spine; the ovipositor is long and slender, exserted, the inner pair of rhabdites chitinous, the middle pair very small, slender and filiform, the 3d and outer pair somewhat incurved, much shorter than those in *Cemonus*, which are long and straight, while in *Cemonus* the mesial pair are not chitinous in the specimens before me, which, however, is apparently of the same age as those of *Passalæcus*; thus showing excellent generic characters.

In the specimen examined, which is a pupa to all intents and purposes, the body is surrounded with a subimago pellicle. It is easily recognized by its long-curved projecting jaws, the long slender body. It was found in small galleries in the stem of syringa the last of May, in company with *Cemonus*.

Rhopalum pedicellatum *Pack.*

Larva.—Body short and thick, tapering rapidly towards the head and tip of abdomen, flattened beneath a little, very convex above; seg-

ments convex, those of the thorax broad, regularly convex, smooth, not thickened posteriorly; quite different from those of the abdomen. The abdominal segments shorter posteriorly above than the thoracic ones. The posterior portion of the segment thickened so as to form a rounded tubercle, which is very prominent and distinct when the body is much curved. This portion is thickened; the tuberculous portion is much smaller in proportion to the rest of the segment than usual in Apidæ. The tip is quite extensible, subacute, terminating in a small knob-like portion. Genitals not apparent, the skin being too thick. A few sparse long hairs over the body, in which respect this genus differs from those of the other families, and it differs in its elongated extensible tip, though it is probable that this part became contracted in alcohol; when contracted, the terminal segment is rather square, not being rounded at the tip. Length of body .25 inch.

The larva burrows in the dust made by the larva of an Ægeria in the pith of the Spiræa, spinning little thin silken cocoons, half a dozen of them occurring in a space of the stem an inch long, lying loose in the galleries, some lying across the stem, and others lengthwise. The cocoon is very thin and slight compared with that of *Crabro sex-maculata*, being composed of only a few silken threads. Found April 18th.

Pupa.—♀. The middle joint of the antennal scape is bent at right angles to the flagellum, the third joint being continuous with the flagellum, while in *Pelopœus flavipes* it is more oblique, as the front of the head is longer and more horizontal, while in Rhopalum it is at right angles to the longitudinal axis of the body. The head is more vertical, less flattened on the pectus of the thorax. Mandibles thick and stout, convex, much more so than in *Pelopœus*. The antennæ do not quite reach to second pair of trochanters; in *Pelopœus*, they reach beyond the third pair; they also reach the tip of the maxillary palpi, which in *Pelopœus* reach half their length. They rest close to each other along the median line of the body. The maxillary palpi are straight, not slightly elbowed near the base; they reach to the tip of the antennæ; the labial palpi are proportionately longer, reaching nearer the tip of the maxillary pair than in *Pelopœus*, and less elbowed or angulated at tip. The anterior tarsi end just before the middle trochanters; the middle tarsi terminate near the end of the pedicel of the abdomen, and the third tarsi end near the middle of the third abdominal segment. Tip of abdomen with the terminal tergite very acute, elongated, extending beyond the ovipositor; the last sternite is oblong, flanked on each side by two cylindrical pieces. On the head between

the ocelli and antennæ are two very prominent acute tubercles. The ocelli are very large: the thorax much as in the imago, but broader, and the propodeum is more horizontal, the enclosure being indistinct; the mesial furrow well marked. The pedicel is broader than in the imago; the rings of the abdomen more dentate on hind edges, while the abdomen, including the propodeum, is much longer than in the imago.

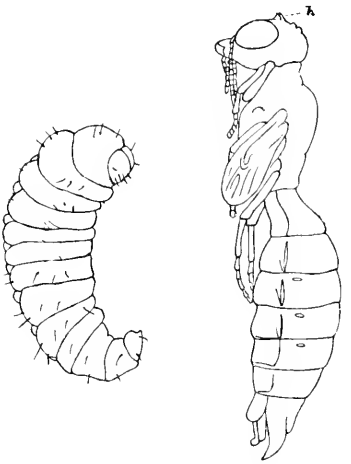

Fig. 3. Larva and pupa of *Rhopalum pedicellatum*, enlarged; *h*, temporary tubercles on head of pupa. (Trouvelot *del.*)

These details of difference in the pupa apply but to the mouthparts, which are not withdrawn in the pupa, as in the imago, and would not, therefore, be so well noticed in the imago, where these parts are much more difficult to compare.

It was interesting to find half-grown larvæ associated with the mature pupa April 18th, showing a possibility of two broods.

Odynerus (probably **albophaleratus** *Saussure*).

Larva.—The head is considerably longer than in *Vespa;* more elongated, narrower and more convex, globose. The clypeus and mouth-parts are more advanced, more prominent. Situation of eyes is not indicated by the narrow testaceous stripe. The supra-clypeal triangular piece is more distinctly marked than in *Vespa* or in the larval Apidae; it is obtusely pointed behind at the apex. The site of the antennæ forms a depressed area on a distinct piece between the eyes and supra-clypeal piece.

The clypeus is very distinct, transversely oblong, with the edges square. The labrum is large and divided deeply with two lobes, which are separated as if composed of two pieces; they overlap the mandibles so that the black tips only remain in sight. Mandibles short, stout, very thick, tridentate; the teeth short, subacute, the innermost being the smallest. The maxillæ and labium are much as usual; prominent, bulging at the end, terminating in the usual papillæ; the lingua represented by a transverse chitinous line. The body is cylindrical, long, a little curved upon itself. The skin is hard and thick, so that the genitals, nerves and dorsal vessel do not show through it. The segments are short, very convex, much thickened, especially on the tergum and the pleural line. The posterior half of each segment is more thickened than in any of the other genera of Vespidæ or Apidæ observed, and also the pleural ridges, giving to the outline of the back a dentate or serrated appearance. Tip of abdomen moderately obtuse.

The larva of *Odynerus* differs from *Vespa* in the long head, square clypeus, the very distinct bilobed labrum, which are unusually deeply fissured, and by the tridentate, stout mandibles; while by the serrated outline of the back it is related more to the larval Crabronidæ and Pompilidæ. It is interesting to observe the distinct supra-clypeal piece.

Odynerus albophaleratus *Saussure.*

Pupa.—Compared with *Vespa* the head is much more horizontal, and there is no supra-clypeal tubercle; the mandibles are much more elongated; the maxillæ and lingua are as much exposed and exserted beyond the tips of mandibles as in *Vespa*, but the whole reach farther towards the end of the body, to the 2d trochanters. The maxillæ and lingua are a little slenderer than in *Vespa*. The antennæ are more oblique at the base, not being bent at nearly right angles as in *Vespa*. They extend just to the 3d trochanters, as the thorax and body generally is wider and shorter than in *Vespa*. The legs spread a little farther apart, but are proportionally of the same length and reach the same relative distance from the end of the abdomen as in *Vespa*. The hind tibial spaces are shorter and smaller than in *Vespa*. The abdomen is much shorter and more spherical; the terminal joints are shorter, being withdrawn more within the abdomen. The ♀ genitals are more acute, the terminal sternite much shorter, smaller and less exserted, than in *Vespa*, while the blades of the ovipositor are much exserted, and longer and slenderer.

Seen sideways, the head of *Odynerus* is more globular, the eyes

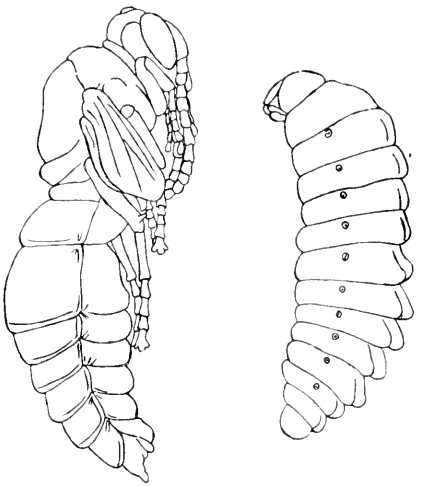

Fig. 4. Larva (enlarged 9 times), and pupa of *Odynerus albophaleratus*. (Trouvelot *del.*)

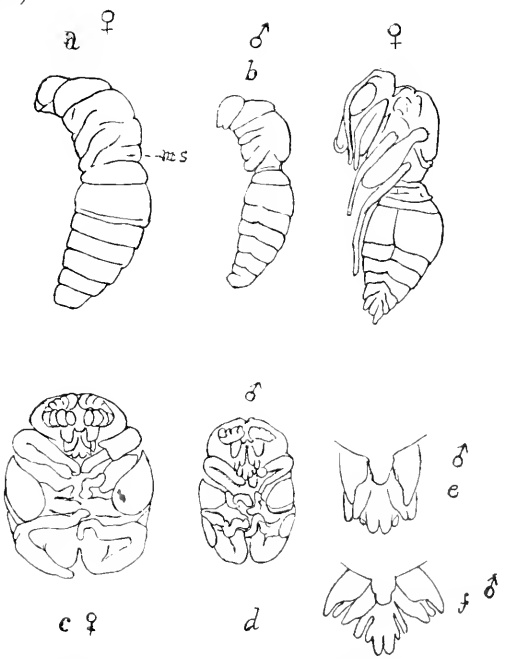

Fig. 5. Semipupal stages *a*, *b*, of *O. albophaleratus*; *c*, *d*, under side of head and thorax of semi-pupa; *e*, *f*, mouth-parts at different stages; *m s*, median segment. (Emerton *del.*)

more indented, the thorax more convex, with the limbs and wings arranged much the same. The propodeum is longer and slenderer, and the subpedunculate abdomen is as in the imago, the two first segments being greatly lengthened over the terminal short retracted ones, and the tip is more incurved, so that the hind tarsi reach to the tip, and the abdomen is rounded ovate, where in *Vespa* it is oblong.

A NEW ANISOTA.

By HARRISON G. DYAR.

Many larvæ of the following species were found at West Palm Beach, Florida, on live oak in January, 1896. I am indebted to Mr. L. H. Joutel for obtaining me food plants for them during the winter.

Anisota consularis, sp. nov.

Male; smaller than the female; body ochreous brown, wings dark purplish brown, a larger ill-defined subhyaline space in the center of the fore wings; a round white discal dot. Terminal space more purplish than the basal part of the wing.

Closely resembles the male of *A. senatoria* in color, but the hind wings are rounded as in the female, not angulated at apex and anal angle, and the t.-p. line is much more obscure.

Female; wings purplish brown, basal and terminal spaces darker; a white discal dot and faint blackish strigæ. Hind wings with a purplish mesial band.

Darker than either *senatoria* or *stigma*, the lines less distinct; wings opaque, not thinly scaled as in *virginiensis*. Types male and female, bred from larvæ.

Larva. Primary spines black, secondary granules sparse, white. Head shining red brown, width 3.5 to 4 mm. Body red-brown, a dorsal, subdorsal (i), lateral (iii), stigmatal and subventral clouded black bands. Dorsal and stigmatal bands harp and narrow, the others clouded, the subventral filling the whole space. All except the subventral are bordered by white shaded lines on the lower side, that below the stigmatal line very distinct. All the lines become obsolete on joint 12, leaving the anal end and all the feet red-brown. In large examples the skin has a fleshy tint, different from the head and plates, while the shaded lines tend to be broken at the primary spines.

The following table will separate the larvæ of *Anisota*.

General color not green.

With secondary white granules.

Brown without distinct black bands..... **stigma.**

A subdorsal and stigmatal dark red stripe and faint black bands..... **virginiensis.**

Ground color relieved by white shades; nine distinct black bands..... **consularis.**

Without white granules; heavily black banded..... **senatoria.**

General color green..... **rubicunda.**

THE LIFE-HISTORIES OF THE NEW YORK SLUG CATERPILLARS.—III–VI.*

(PLATES VI–IX.)

By HARRISON G. DYAR, A. M., Ph. D.

Tortricidia pallida Herrich-Schäffer.

1854—*Limacodes pallida* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 183.
1854—*Limacodes flavula* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 185.
1864—*Tortricidia pallida* and *flavula* PACKARD, Proc. Ent. Soc. Phil. III, 347.
1891—*Tortricidia flavula* DYAR, Psyche, VI, 128.
1892—*Tortricidia pallida* and *flavula* KIRBY, Cat. Lep. Het. I, 551.
1892—*Isa textula* MORTON, Ent. News, III, 1.
1892—*Tortricidia flavula* DYAR, Ent. News, III, 62.
1894—*Tortricidia flavula* NEUMOEGEN and DYAR, Jour. N. Y. Ent. Soc. II, 75.

LARVA.

1891—Dyar, Psyche, VI, 145.
1892—Morton, Ent. News, III, 1. (as *Isa textula*).
1893—Packard, Proc. Am. Phil. Soc. XXXI, 104 (as young larva of *Heterogenea sp.*).
1893—Packard, Proc. Am. Phil. Soc. XXXI, 105 (as *Heterogenea testacea*).
1893—Packard, Proc. Am. Phil. Soc. XXXI, 106 (as *Heterogenes flexuosa*).
1894—Dyar, Ann. N. Y. Acad. Sci. VIII, 220.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space moderately broad, narrowing only a little toward the extremities, arched; lateral space broad, oblique, concave; subventral space small, retracted. Ridges slightly prominent, never tubercular, furnished with single or furcate swollen-tipped setæ in stage I, afterward smooth or with rudimentary setæ. Outline from dorsal aspect elliptical notched at the anterior part of joint 13 to form a short quadrate tail. Skin covered with close, appressed, rather large, clear granules which appear immediately after the first molt and increase slightly in number at subsequent molts. Depressed spaces large, well developed, deep with sharp perpendicular sides, the bottom flat and finely granulated. These spaces are very conspicuous and so large as to divide the coarsely granu-

* Miss Morton has given up her coöperation in these articles. The assistance which she has kindly continued to furnish me will be specially acknowledged in each case.

lar general surface into a series of latticed ridges. They are as follows: (1) large, intersegmental, angularly elliptical; (2) small, addorsal, segmental, rounded triangular; (3) under the subdorsal ridge, small, triangular, shallow; (4) large, lateral, intersegmental, elongate or narrowly elliptical; (5) of moderate size, above the lateral ridge, rounded triangular, segmental; (6) very small, shallow, alternating with the lower part of the fifth series just above the lateral ridge. In the subventral space a shallow ill-defined series (7) alternate with the spiracles, and another similar one (8) is situated below them.

This larva is throughout very smooth, the setæ practically disappearing at first molt. The coloration is green, a large red mark in the shape of an irregular diamond or large blurred cross gradually appears on the back, beginning in the form of a small patch between two yellow lines. The marking appears to be mimetic of red patches or galls on its food plants.

The larva is rather highly specialized, especially in regard to its skin structure which somewhat approaches that of *Eulimacodes*, while the setæ disappear early. Its shape, however, is quite normal and typical of the smooth Eucleids in general, and the setæ of stage I are in a less advanced degree of degeneration than in *Apoda y-inversa* or *Tortricidia fasciola*.

AFFINITIES, HABITS, ETC.

This larva is allied to the small species which I have doubtfully identified as *Heterogenea flexuosa* and doubtless also to the European *H. asella*, though this has not been examined by me. It belongs to the group of the northern smooth Eucleids, and represents a more primitive state than *Apoda* in that setæ *ia* and *ib* on joint 4 and i and ii on joints 5 to 12 are partly united into a furcate or Y-shaped spine, both limbs of equal length, whereas in *Apoda* one limb has been reduced to a slight prominence.

The moths emerge over a considerable period of time. Full grown larvæ may be found unusually early, often during July, while others do not mature till late in September. This power of early emergence gives the species a northern range. In the Adirondacks it was the only Eucleid met with. In Long Island eggs and young larvæ were found on the trees at the same time that other larvæ were matured.

The larva is a rather low feeder, occurring on higher bushes and the lower branches of trees, along the edges of woods, etc., not as a rule in very shaded locations. Rarely more than one larva is found on

the same plant. The larva remains on the back of a leaf, where its shape and coloration are adapted to its concealment.

The material from which this life history was worked out was collected by me in stage I at Keene Valley and the eggs found at Bellport, Long Island. Miss Morton endeavored to obtain fertile eggs from some cocoons which I sent her, but was unable to do so. I am indebted to Mrs. Knopf for assistance with the plate.

Criticism of Previous Descriptions.

This larva remained undescribed till very recently. In my original description I say "the usual elliptical depressions hardly distinct." This may be corrected by omitting the word "hardly." Miss Morton first described the eggs. She says they are "without form," though I should describe them as regularly elliptical and greatly flattened. I do not find them "invisible to the naked eye on the leaves" since I have found them in the woods without the aid of a lens. Dr. Packard's descriptions seem to contain but one error, besides the inaccurate nomenclature, for which I am partly responsible. His "young larva of *Heterogenea*, sp." is stage VI, and his "full-grown larva of *Heterogenea testacea*" and "larva of *Heterogenea flexuosa*?" are stage VII of *T. pallida*. The "full-grown larva of *Heterogenea*, sp." is another insect.* The error referred to is on page 105, where Dr. Packard says "there is a median dorsal row of impressed rounded warts, which do not bear bristles . . . ". I think it is evident that these structures are the glandular centers of the dorsal depressed spaces, and have no homology, or even analogy with warts.

Description of the Several Stages in Detail.

Egg.—Elliptical, flat, transparent on smooth green leaves, whitish translucent on whitish leaves, shining; reticulations faint, visible in a strong side light under a half inch objective as narrowly linear elongate hexagonal lines, slightly more opaque than the shell. Size 1.0 x .6 mm. Laid singly on the under side of the leaf.

Stage I.—(Plate VI, figs. 1 and 2) Elliptical, rather elongate, dorsal and lateral spaces rather broad. Along the subdorsal ridge, a row of Y-shaped setæ with expanded cleft tips, changing to two separate setæ on joints 3 and 13; two lateral setæ on joints 3 and 4; along the lateral ridge a row of single swollen-tipped setæ on joints 3 to 12.

* Doubtfully identified Journ. N. Y. Ent. Soc. III, 146, as *Heterogenea flexuosa*.

Color translucent whitish with a slight green tint after the larva has eaten. Skin smooth. Length .7 to 1.1 mm. The larva feeds normally throughout the stage.

Stage II.—Setæ rudimentary, the mature structures well assumed. More rarely distinct, short, black setæ persist, arranged two on the subdorsal ridge, one on the lateral ridge. Subdorsal ridge rather square, dorsum flat, rounded; tail quadrate, sides concave. Lateral ridge moderate, subventral region small, retracted. Depressed spaces all present as in the mature larva, deep, pit-like, the latticed ridges narrow, distinct, composed of one row of large, clear, appressed granules. Color pale greenish without marks. The larva eats a track the width of its body, but only two or three times as long as wide. Length 1.1 to 1.7 mm.

Stage III.—Elliptical, tail rounded quadrate; all pale green. Skin structure the same as before. Usually the setæ are so rudimentary as scarcely to be visible; more rarely, quite distinct. The larva has the shape and appearance of the mature form, but is without marks. Toward the end of the stage a yellow subdorsal line may appear, with a round reddish patch centrally on the back. Length 1.6 to 2.2 mm.

Stage IV.—Elliptical, both ends rounded, the anterior more obtusely; dorsum arched, the highest point a little before the middle. Ridges low, not prominent, the subventral ridge shorter than the lateral. Body smooth, not tuberculate nor scalloped, setæ nearly obsolete. Skin coarsely clear granular, except on the large depressed spaces which are arranged as in the mature larva. The granules along the lateral ridge are subpapillose, slightly divided at the tip in some cases. Subventral space more coarsely granular. Color light yellowish green, a trace of reddish along the dorsal space on joints 6 to 9. Length 2.2 to 3.3 mm.

Stage V.—Subdorsal ridge rounded, lateral moderately prominent, smooth, as before; tail subquadrate, a little contracted at the base. Green, a wine red shading occupying the dorsal space on joints 7 to 9 with traces of a yellow subdorsal line. Skin surface much as before, but the granules on the latticed ridges are more numerous, forming more than one row. They resemble angularly appressed glass beads. Setæ obsolete, scarcely discernible except at the ends of the body. Subventral depressed areas rather well developed, comma-shaped, composed of the larger upper one (7) joined to a smaller lower one (8); the granules are more pointed and less well developed than above the lateral ridge. Later, in the larva observed, the dorsal patch became pentagonal, vinous red, pale centrally and covering three greenish im-

pressed spots; broadly bordered with yellow, which color also extended along the subdorsal ridges half way to the tail. Length 3.5 to 4.7 mm.

Stage VI.—Depressed spaces deep and well marked, finely shagreened granular in the bottom. Latticed ridges coarsely densely clear granular as before. Areas in the subventral space reniform, (7) and (8) conjoined, the granulations of this space finer than above the lateral ridge. Body green, at first scarcely marked, but during the stage the dorsal red patch appears. This varies greatly in shape in different larvæ, from a small transverse bar (Plate VI, fig. 3) to a large patch covering the dorsum of joints 5 to 9 and extending part way down the sides. There is a more or less distinct yellow subdorsal line, broken where it crosses the red patch, the patch bordered with crimson and yellow. The patch is of a varying shade of purplish red with a more or less distinct central square blotch on joints 7 and 8, the enclosed depressed spaces of dorsal row (1) centered with a dark dot. The patch may have an irregular outline as in the mature larva, but it does not reach either extremity. A small reddish patch may occur on joint 3. Length 4.7 to 6.7 mm.

Stage VII.—Smoothly rounded, elliptical, the tail subquadrate; highest through joint 5, evenly rounded (Plate VI, fig. 5). Subdorsal ridge rounded, dorsal space rather narrow, lateral broad, gradually sloping. Lateral ridge smooth, prominent, exceeding the subventral ridge. Subventral space small, hollowed. Depressed spaces large and deep, arranged as described above (Plate VI, fig. 8), their bottoms finely granular. Latticed ridges coarsely clear granular. Body green with a large dorsal marking which varies from narrow (Plate VI, fig. 6) to broad* (Plate VI, fig. 7) and from bright red to dull purplish in different examples. It has a pale salmon colored center, often square and covering only one depressed space (joints 7–8) or rarely larger, occasionally wanting. The patch is bordered with crimson and yellow and is usually darker around the edge and on the latticed ridges. It usually narrows on joints 3 to 5, widens again, reaching the lateral depressed space (4) on joints 5–6, is incised in a curve and broadens to the lateral margin at joint 8; narrows again in an incised curve to the depressed space (4) on joints 9–10, and there tapers to the tail, thus forming a large, blurred red cross. Most of the depressed spaces on the sides are pale with darker green centers. Length of the larva 6.7 to 9.5 mm.

*It is difficult to illustrate the range in the size of this marking without a long series of figures. The patch may be even larger than shown in figure 7.

Cocoon.—With the characters of the group.

Food-plants.—Oak, wild cherry, birch, maple, chestnut and witch-hazel have been observed.

EXPLANATION OF PLATE VI.

Fig. 1. Larva in stage 1, dorsal view enlarged.
" 2. The same, side view.
" 3. Young larva × 5, the dorsal marking just starting.
" 4. The same, older × 5.
" 5. Side view of mature larva, anterior end to the right.
" 6. Mature larva, enlarged, restricted pattern.
" 7. Another larva, broad pattern.
" 8. Larva, dorsal view, showing the depressed spaces of dorsal and lateral areas; *a*, dorsal depressions (1); *b*, addorsal (2); *c*, upper lateral segmental (3); *d*, lateral depressions (4); *e*, lower segmental lateral (5); *f*, lower intersegmental lateral depressions (6).
The left side of joint 7 (third abdominal segment) illustrates the granulation.
" 9. *T. pallida*, imago.

Eulimacodes scapha *Harris.*

1855—*Limacodes undifera* WALKER, Cat. Brit. Mus. pt. V, 1149.
1864—*Limacodes scapha* WALSH, Proc. Bost. Soc. Nat. Hist. IX, 298.
1864—*Limacodes scapha* PACKARD, Proc. Ent. Soc. Phil. III, 341.
1878—*Eulimacodes scapha* MOESCHLER, Verhl. Zool.-bot. Ges. Wien, XXVII, 672.
1882—*Limacodes (Eulimacodes) scapha* GROTE, Check List, 17.
1891—*Limacodes scapha* SMITH, List, Lep. 28.
1892—*Eulimacodes scapha* KIRBY, Cat. Lep. Het. I, 535.
1894—*Eulimacodes scapha* NEUMOEGEN & DYAR, Journ N. Y. Ent. Soc. II, 73.

LARVA.

1841—HARRIS, Rept. Ins. Mass. 303.
1864—PACKARD, Proc. Ent. Soc. Phil. III, 341.
1869—HARRIS, Ent. Corr. pl. 3, fig. 8.
1873—STRETCH, Zyg. & Bomb. N. A. 201.
1881—PACKARD, Bull. 7, U. S. Ent. Comm. 77.
1883—EDWARDS & ELLIOT, Papilio, III, 128.
1885—DIMMOCK, Psyche, IV, 279.
1885—HUBBARD, Ins. Affect. Orange, 144.
1890—PACKARD, 5th Rept. U. S. Ent. Comm. 147, 490.
1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 98.
1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 223.
1895—COMSTOCK, Guide Stud. Ins. fig. 257.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal area broad, narrowing before to a rounded margin on joint 3, narrowing behind to a point in the tail-like termination of joint 13. Lateral area absent, the subdorsal and lateral ridges at first closely approximate, later fused into a single, sharp, high, rounded ridge. Subventral area broad, forming all the sides, perpendicular, flat or hollowed, highest in the middle, diminishing to almost nothing at both extremities. Subventral ridge very slight, just indicated at the lower edge of the body. Primitive first stage absent, the warts present in stage I reduced by degeneration, bearing two setæ, uniformly developed; in the later stages disappearing, the rudimentary setæ persistent. Subventral row represented by small setae. Both the lateral and subdorsal warts are situated on the single subdorsal ridge. Depressed areas strongly developed but scarcely sunken, flat, plate-like, shagreened and with angular margins; the dorsal row (1) elongate transversely, hexagonal, the addorsal (2) small, rounded triangular; those of the lateral area wanting; subventral plates fully developed, rounded angular, the upper subventral (7) large, ovate, the lower (8) rounded triangular; two other small rows above the subventral edge (9) and near the spiracles (10). Skin at first almost smooth, but soon covered with granules which are flattened, appressed and rounded and appear as if overlapping like the scales on a fish, on the sides from below upward, outwardly from the middle of the dorsum to the upper side of the subdorsal ridge where the two directions of scaling meet. The scaling is only present on the latticed ridges between the closely set, slightly sunken armor plates (metamorphosed depressed areas). There is a slight hump or rounded angulation on the ridge at joints 7–8, but this may be absent or there may be two such humps, the second at the junction of joints 8 and 9. Just under the edge of the subdorsal ridge from side view is a series of glandular spots which can secrete drops of a clear odoriferous fluid. They are situated above and a little before the upper side of the large intersegmental plates (7) and appear in the cast skin as round beads. It is possible that they represent the depressed spaces of lateral area.

The coloration is adapted for concealment, the green ground work variously patched and spotted with yellowish and brown being obscure on the leaves toward autumn. The peculiar square box-like shape, produced by the union of subdorsal and lateral ridges, may be of use in suggesting to its enemies an appearance unlike that of most insect larvæ, more unusual indeed than the majority of Eucleidæ.

This larva is on the whole the most highly specialized North American Eucleid. It belongs to the group of smooth Eucleids, but is the only one in which the primitive first stage has disappeared. Though it lacks the specializations of the spined Eucleids, it exceeds them by the number of its peculiar modifications, namely, the union of the ridges to the exclusion of the lateral space, the high modification and development of the depressed spaces and the conversion of the skin granules into scales.

AFFINITIES, HABITS, ETC.

The genus *Eulimacodes* was founded by Moeschler on a species from Surinam. A larva apparently identical with our *scapha* is figured by Sepp (Suranim. Vlinders, Pl. 129) from this locality, but the moth, which he calls *gibbosa*, is quite distinct. Of our two species one is found in Arizona and doubtless occurs farther south. Therefore we may regard the present species, *scapha*, to be of South American origin and we should not expect to find it represented in the European fauna.

The moths fly in July and the larval stages occupy the summer months, the insects reaching maturity in August and September. The eggs are laid singly and the larvæ live on the under sides of the leaves, solitary, though not greatly scattered, as often several or many occur on the same plant.

There is a wide range in variation with something of a local tendency. In Long Island the form with smooth subdorsal ridge is common, with no hump or only one small one (Plate VII, fig. 13). The back is green or variously spotted with yellow and brown, rarely entirely brown, the sides generally green. In the wooded parks near New York the single or double humped form is more common, often with brown markings on the sides. The larva shown in fig. 14 was collected at Fort Lee, N. J., and a curious example with two humps on one ridge and but one on the other occurred at Scarsdale, N. Y. I have collected a long series with a wide range in variation near Woodstock in Greene county.

I am indebted to Miss Morton for a number of young larvæ and to Mr. Doll for fertile eggs and cocoons. Mrs. Knopf has kindly assisted with the plate.

CRITICISM OF PREVIOUS DESCRIPTIONS.

We have several recognizable figures of this peculiar larva, but no full account of its life history. Dr. Packard describes two of the early stages, calling them "II?" and "IV, or that before the last." I infer from the

measurements given that they really were stages IV and V. Two of the references include a general account of the finer external structure. A general and not unnatural error has been made in considering the sunken armor plates to represent the segments. Edwards and Elliot say "the *segments* are arranged like the plates of a tortoise," Dr. Packard refers to a marking "along the *sutures* . . . of the segments," and I have said "joints 3 to 13 have each a plate." These structures are situated between the segments, overlapping on two adjoining ones. Dr. Packard found but seven spiracles; but he must have had before him an abnormal larva, as all my specimens possess the usual number.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, flat, 1.8 x 1.2 mm., the skin very thin, white and iridescent; the fresh egg is transparent with a slight pale yellow tint when laid on glass and becoming more opaque as the embryo develops but not darkening in color. Reticulations rounded, obscure, rarely angular, not characteristic; the surface of the egg is slightly shagreened. Another egg measured 1.7 x 1.4 x.1 mm. Laid singly on the leaves.

Stage I.—Elliptical, more pointed behind than before; dorsum flat, a little arched, separated from the perpendicular sides by a ridge bearing two rows of tubercles, each with two setæ (Plate VII, figs. 1 to 3). These represent the usual subdorsal and lateral rows, but situated in close approximation to each other. On joint 3 are four tubercles, on joint 4, three, and on joint 13, three. A subventral row of simple setæ. The shape is less boat-like than the mature larva, though all the essential features are indicated. Pale yellowish, a broad dark band along the ridge below the skin and therefore appearing in a slightly different position according to the point of view. The band is connected with its fellow at the ends and also by a bar in the center of the dorsum. Dorsal skin smooth, depressed in gentle hollows representing the dorsal (1) and addorsal (2) depressed spaces; bases of tubercles wrinkled, subgranular; lateral (subventral) skin also smooth, with two rows of faint depressions. Venter clearer yellow than the body; head pale. Length 1.2 to 1.9 mm. The larva feeds in this stage.

Stage II.—Tubercles absent, a single tiny seta represents each. Subdorsal ridge rounded, prominent. Dorsum hollowed, sides perpendicular. Skin obscurely granular, the granules flattened, nearly contiguous, not really overlapping but suggesting scales, especially before

the larva is filled out by feeding. Depressed areas irregularly sculptured, creased, regular, the dorsal (1) transversely elongate, hexagonal, addorsal small, rounded; latticed ridges very narrow, almost linear, but the areas not much depressed. Sides hollowed below the round bulging ridge, which has a segmental row of round clear glandular areas on its lower aspect; surface slightly granular without well-defined sculpturing, two angular areas just indicated, the upper (7) pentagonal, the lower (8) rounded. Color greenish, the ridge broadly brown with the connecting band as before at the highest part of the dorsum. The back is a little angled at the segment posterior to this band (joints 7–8). Length 1.8 to 2.9 mm.

Stage III.—Much as before, but the depressed areas or plates are better defined. They are large, almost contiguous, still somewhat depressed, irregularly shagreened, the narrow latticed ridges, and especially the high bulging subdorsal ridge, distinctly scaled as in the full-grown larva. The dorsal plates (1) have a paired character as seen by a central line and two glandular dots on each side (Pl. VII, fig. 7). On the sides the plates are depressed, not very distinctly bounded. There can be distinguished besides those formerly seen (7 and 8) also a small segmental row just above the subventral edge (9). Dorsal and lateral areas sunken, ridge prominent, rounded, smooth. Shape elliptical, square anteriorily, tail obtusely pointed, the back evenly arching from head to tail. Coloration at first as before, but soon the great diversity in individual markings appears. In three larvæ from eggs laid by the same moth, three types appeared. The sides in all remained pale green, but the back was variously marked with reddish-brown. The extent of variation is from the minimum of a line along the subdorsal ridge with connecting transverse bar to the maximum of a complete brown dorsal space. Length 2.9 to 3.9 mm.

Stage IV.—The larva now exactly resembles the mature form except in size. The plates are quite distinct and the scale-like skin granules well developed. Markings better defined than before and as various as at maturity. Length 3 9 to 5 6 mm.

Stage V.—Head greenish-white, eye black, jaws brown with two black bands; palpi pale. All the plates are distinct (Plate VII, figs. 7 and 8), the scaling as in the mature larva. Plates shagreened, scarcely sunken, the dorsal ones (1) divided by a slight raised line. Hump on joints 7–8 quite well marked, but varying in different larvæ; tail round pointed. In an example selected for description the dorsum was creamy-brown, the ridge above, all the dorsal latticed ridges and a nar-

row dorsal line on the second to eighth plates dark-brown; hump opposite fifth plate very dark; glandular centers of plates also dark; a white spot in the ridge at the eighth plate (joint 10–11) and a little one at the seventh plate best seen from the side. First dorsal plate and all the sides dark leaf-green, the glandular centers of the upper plates (7) dark. Length 5. 6 to 7. 9 mm.

Stage VI.—Shape and markings as in the next stage. The last four stages are throughout practically alike. Length, 7.3–12 mm.

Stage VII.—Elliptical, ending in a pointed tail; dorsum slightly concave (Plate VII, fig. 6) lowest along a line just above the subdorsal ridge where the dorsal and lateral scaling meets, greatly arched; sides perpendicular, concave, diminishing at each end and without ridges, the whole shape box-like. Setæ fine and obscure, a single one on the dorsal and lateral aspect of the ridge and a few microscopic ones on the sides near the spiracle, the latter secondary. Depressed spaces converted into scarcely sunken angular plates, the dorsal ones (Plate VII, fig. 7) suggesting the plates of a tortoise. A row of ten segmentary glands on the lower side of the subdorsal ridge secrete an odoriferous fluid when the larva is irritated. Plates as described above, the latticed ridges scaled, the two directions meeting at the lowest point of the dorsum (Plate VII, fig. 11); scales arranged as if overlapping (Plate VII, fig. 12); plates irregularly finely granular (Plate VII, fig. 12). Setæ weak, normal (Plate VII, fig. 5). Opposite the fifth dorsal plate the ridge is thrown into a prominence more or less distinct, sometimes also one at the sixth plate (Plate VII, fig. 14). These humps are intersegmental, representing the incisures of joints 7–8 and 8–9. A white spot on the ridge at eighth plate. Color very variable, scarcely two specimens alike. Ground color green, more or less replaced on the dorsum by brown or yellow or both, variously mottled and spotted, the latticed ridges and glandular spots darker usually. Sides less commonly marked with brown, but occasionally so and independently of the dorsum. The order of appearance of the dark marks is from the hump and white spot, spreading on the dorsal area, and from the middle of the subventral edge and the white spot, spreading on the lateral area. I have not seen either an entirely green or entirely brown specimen. Length, 12 to 18 mm.

Food-plants.—Various shrubs and trees. Oak, chestnut, wild cherry, hickory, sweet gum, bayberry, linden, witch hazel and hop hornbean have been noted by me.

EXPLANATION OF PLATE VII.

Fig. 1. Larva in stage I, dorsal view, enlarged.
" 2. One tubercle, more enlarged.
" 3. Stage I, side view, semidiagrammatic, to show arrangement of tubercles.
" 4. Young larva, stage IV, enlarged.
" 5. Seta of subdorsal ridge, mature larva.
" 6. Front view, stage VI, showing the high ridge and hollow dorsal area.
" 7. Dorsal view, stage VI, showing the armor plates and their arrangement.
" 8. The same, side view, showing the plates of subventral area.
" 9. Feeding traces on a small white oak leaf.
" 10. *Eulimacodes scapha.*
" 11. Skin on dorsum, a portion of one segment showing part of two plates, the latticed ridge between and the addorsal plate as far as the subdorsal ridge.
" 12. The joining of the scaled latticed ridge and the armor plate, more enlarged.
" 13. Mature larva, slightly enlarged, Long Island form, without humps.
" 14. The same, two-humped form from Fort Lee.

Phobetron pithecium *Smith & Abbot.*

1797—*Phalæna pithecium* SMITH & ABBOT, Lep. Ins. Georgia, II, pl. 74.
1827—*Phobetron abbotana* HÜBNER, VERZ. bek. Schmett. 398.
1841—*Ecnomida pithecium* WESTWOOD, Nat. Lib. Exot. Moths, 183.
1841—*Limacodes pithecium* HARRIS, Rep. Ins. Mass, 304.
1864—*Phobetron pithecium* PACKARD, Proc. Ent. Soc. Phil. III, 340.
1864—*Thyridopteryx nigricans* PACKARD, Proc. Ent. Soc. Phil. III, 350.
1864—*Limacodes hyalinus* WALSH, Proc. Boston Soc. Nat. Hist. IX, 299.
1864—*Limacodes tetradactylus* WALSH, Proc. Boston Soc. Nat. Hist. IX, 300.
1869—*Limacodes pithecium* HARRIS, Ent. Corr. 244.
1885—*Phobetron pithecium* DIMMOCK, Psyche IV, 280.
1894—*Phobetron pithecium* NEUMOEGEN & DYAR, Journ. N. Y. Ent. Soc. II, 70.

LARVA.

1797—SMITH & ABBOT, Lep. Ins. Georgia, pl. 74.
1841—HARRIS, Ins. Inj. Veg. 304.
1856—FITCH, Third Report Ins. N. Y. 381.
1858—DUNCAN, Nat. Libr. XX, pl. 21.
1862—MORRIS, Synop. Lep. N. A. 127.
1863—WALSH, Proc. Bost. Soc. Nat. Hist. IX, 297.
1870—RILEY, Am. Entomol. II, fig. 209.
1872—LINTNER, 26th Rept. N. Y. State Cab. Nat. Hist. 149.
1881—PACKARD, Ins. Inj. Forest Trees, 47.
1883—SAUNDERS, Ins. Inj. Fruits, 112.
1885—HUBBARD, Ins. Affecting Orange, 143.
1889—LINTNER, 5th Rept. N. Y. State Entomol. 184.
1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 97 and 101.
1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 218.

Special Structural Characters.

Outline rounded quadrangular, exclusive of the appendages, dorsal space broad, even, flat; lateral space broad, subventral comparatively broad, continuous with the lateral space, not retracted. Ridges practically absent, the subdorsal indicated by the change in direction of slope between back and sides. Tubercles greatly modified: stage I represents a primitive first stage, but tubercles i and ii on abdomen, ia and ib, iia and iib on thorax are completely united into a single spine, probably by a process, such as is indicated by the Y-shaped and pronged setæ of *T. pallida* and *T. fasciola*. Tubercle iii of joint 5 is absent. After stage I the setæ reappear double, normal. The ultimate structure of the warts, which appear at first molt, is remarkable. The subdorsal series are attached by very broad bases, greatly encroaching on the dorsal and lateral spaces, and are produced laterally into fleshy appendages of different lengths. These appendages are constricted at about the center of the attachment; the basal part bears seta i in its center; the terminal part bears seta ii at the apex. The lateral row of warts form small, rounded, button-like structures, concealed for a long time beneath the large subdorsal appendages. These warts of both rows are composed of soft spongy tissue and they readily become detached at their bases, leaving a small denuded area, which does not bleed. If the appendages are detached toward maturity, they are not regenerated; but if early in life a partial regeneration occurs at each molt, so that the structure may attain nearly its normal appearance. The subdorsal warts are each pushed a little forward so as to partially cover the segment in front. The warts bear at first stiff, smooth, pale setæ. Gradually a series of fine, secondary, branched hairs (Plate VIII, fig. 11) appears, and in the last stage, completely replaces the primary coating, leaving only the primitive setæ and a few club-shaped black hairs, which represent the last degenerate form of the original coating. In the case of the lateral horns the change from simple to fine branched hairs at the last molt is more sudden. The skin is covered with a sparse coating of fine black hairs from large tubercles (Plate VIII, fig. 15). The depressed spaces are hardly represented at all; the spiracular series (7) only is faintly shown. The appendages are formed by the subdorsal horns of joints 4 to 12 inclusive; all the others form warts of the small button-like type.

This curious larva seems to mimic a dead dry leaf. In respect to its adaptive characters it is highly specialized, perhaps the most highly specialized of any Eucleid; yet in respect to its setæ it is very primitive. It belongs distinctly to the section of spined larvæ from the absence of

a tubercle of the lateral row on joint 5, and the moving up of the spiracle; yet it is without stinging spines, the warts are hairy, a primitive first stage is present as in no other spined Eucleid, and the arrangement of the warts on the thorax corresponds strictly with that of the smooth Eucleids, there being three well developed warts on joints 3 and 4. It is, therefore, a generalized form, a connecting link between the groups of Eucleidæ and of particular interest. If we disregard its special adaptation, which is unique, this form represents the early stem of the spined Eucleids, at a time before the primitive first stage was lost, before the setæ had become poisonous spines and while the original number of warts were yet present on the thorax. It is only slightly removed from the stem of the smooth Eucleids, differing from them in the specialization of joint 5, the complete coalescence of setæ i and ii in stage I, and in the only partial degeneration of the original setæ* of the warts, which is complete in the smooth Eucleids, but in Phobetron advances slowly throughout ontogeny. The number of larval stages appears to be abnormally large. I have not specially investigated the constancy of this number.

AFFINITIES, HABITS, ETC.

The allies of this larva are to be found in South America. Stoll figures the larva of *hipparchia* exactly like that of *pithecium*, as far as can be seen from the figure. We have also in Florida the species *beutenmuelleri*, which seems nearly allied, though the larva is unknown. The habits are in general similar to those of the other Eucleidæ. The eggs are laid singly, and the larvæ live on the under sides of the leaves till the last stage, where they rest on the upper side and feed fully exposed. Full grown larvæ may be found during September; the eggs are laid in July, and there is but a single brood.

The full grown larva strikingly resembles a part of a dead leaf which had fallen on the surface of the foliage.

For material I am indebted to Miss Morton for the eggs and stages I and II, which she obtained from moths bred from cocoons which I sent her for that purpose. I have also found the larva as young as stage III, at Bellport, Long Island. Mrs. Knopf kindly made the original drawings of figures 2 to 7, 13 and 14 of the plate.

* The primary setæ remain on the warts, single; the secondary wart hairs degenerate and almost completely disappear in the last stage; the final coating of fine hairs is, therefore, tertiary, and belongs to the special adaptations.

CRITICISM OF PREVIOUS DESCRIPTIONS.

There are no descriptions of the youngest stages of this species. The references given above cover descriptions and figures of the mature larva, many of them inadequate. Walsh describes a larva as *tetradactylus* with but four pairs of long appendages instead of six. I think he had before him a specimen in which the appendages of joint 8 were broken off on both sides, which would leave "the third and sixth pairs" long as he describes, if the missing appendages be not counted. This is very probable, as I often find larvæ in various degrees of dilapidation. A specimen occurred in which all the appendages were absent except the last two pairs. It was a hardly recognizable object, yet alive and healthy. I have also recorded* an example in which the third appendage (joint 6) was absent on both sides.

Dr. Packard described a larva as "*Phobetron*, sp.," apparently regarding it as distinct from the common form; but his brief description contradicts *pithecium* in nothing. This larva is said to possess some stinging power, but Dr. Packard figures no stinging spines among his excellent plates (Proc. Am. Phil. Soc., xxxi, pl. II and III, figs. 11 and 12), and I have been unable to find any such on the larva.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Flat, circular, not elliptical as usual, scarcely shining, dark ocher yellow, almost brownish; diameter 1.2 to 1.4 mm., height about .1 mm. Reticulations rounded hexagonal, regular, very obscure scarcely defined lines resembling the joinings of cells. Laid singly, very rarely two overlapping. The developing embryo finally causes the egg to turn dark brown. Hatches in 10 days.

Stage I.—Rounded elliptical, the spaces proportioned about as in the mature larva, on joints 3 and 4 are three, on joint 5 one, and on joints 6 to 13, two each of long spines, subequal, composed of a tapering proximal portion with enlarged base and more slender tapering distal portion (plate, figs. 1 and 2). Of the subdorsal row, those on joints 7, 9 and 11 lean outwardly, alternating with the others. All have the bases slightly wrinkled. Below the spiracles a series of setæ arise from the subventral edge. Color dark brown, darkest along the subdorsal ridges; a broad whitish dorsal line. Spines white at base, the ends of the proximal part (hypertrophied tubercle) black, the distal part (seta) dusky, both finely spinulose. Head blackish, especially on the vertex.

When first hatched, the tubercles are small and bear only the dusky

* Ann. New York Academy of Sciences, VIII, 218, note 2.

setæ, shorter than the white hairs of subventral row; but soon the tubercles elongate, forming the pale basal portion of the spine. Skin smooth, slightly shining. The larva feeds in this stage. Length 1.2 to 1.8 mm.

Stage II.—Instead of the spines of the subdorsal row are now present on joints 4 to 12 a series of laterally extended, short, conic, fleshy appendages, projecting about half their length beyond the sides; those on joints 7, 9 and 11 much shorter than the others, which are of equal length; all densely covered with coarse, smooth, pale spines. The other setæ, namely all those of joint 3, the lateral row and those on joint 13 form small pale tubercles, with a single hair, inconspicuous, being obscured by the appendages of the subdorsal row. Color dead-leaf brown, the tips of the appendages whitish, the outline evenly fringed by the white spines. Dorsal space narrow, clothed by a few small dark setæ. On the sides, owing to the broad attachment of the subdorsal appendages, the lateral space occupies but one-third, the subventral space two-thirds of the area, both perpendicular. Lateral area brown; subventral dull whitish. Length 1.8 to 2.5 mm.

Stage III.—(Plate VIII, fig. 3) Elliptical, the back flat, produced by laterally extended appendages; side area small. Appendages as before, but longer, each slightly constricted near the base, rather sparsely covered with stiff, pale setæ, arising from conical bases. Yellowish-brown, a double blackish spot on the top of each appendage, the tips pale; subventral edge white. A tuft of fine short hairs in the center of each segment of dorsal space. Lateral tubercles with single seta; subventral setæ double. Head testaceous, the eye black. Length 2.5 to 3.5 mm.

Stage IV.—Appearance as before, but the horns are more densely covered with the sharp stiff, pale-yellowish setæ. The basal portion of each horn is divided off by a constriction, approximately bisecting the short horns. The horn on joint 11 is proportionately longer than before; otherwise as in the previous stage. Color brown, fringed by the pale spines, the long horns shaded in a darker tint. Length 3.5 to 5 mm.

Stage V.—(Plate VIII, fig. 4) The discrepancy in the sizes of the horns has increased. Those on joints 6, 8 and 10 are elongated, those on joints 7 and 9 remain short and that on joint 11 is about as long as the one on joint 12. The lateral tubercles are almost invisible, being covered up by the subdorsal ones; but they are furnished with a crown of stiff hairs besides the central seta. Color brown, the horns darker

with a central pale line and pale tip; setæ pale, simple as before, but supplemented by many very fine short curved hairs, also simple. The primitive setæ may be distinguished, arranged as in the mature larva, i on the basal portion, ii on the apex of the subdorsal horns. Length 5 to 7 mm.

Stage VI.—Long horns longer, short ones shorter in proportion than before, the second, third and fifth pairs (joints 5, 6 and 8) curved backward, sickle-shaped the seventh pair (joint 10) forward. Nine pairs visible from above, first and eighth short, fourth and sixth very short. Each has a distinct constricted basal piece, the terminal setæ of both portions arising from a round tubercle. Horns covered with large stiff, smooth, pale setæ and also with fine, short, broadly branched hairs which become very dense at the apices of the long horns, giving the appearance of rusty brown tips. On the short horns these fine setæ are few or absent. A few dark hairs on the dorsum as before. Lateral horns and the lower ones of thorax short, conic, with many pale spines and a pale bare tip. Color brown, the horns darker with a white stripe up the middle. Subventral area broadly white. As the larva grows the bases of the subdorsal horns swell up on the lower side. Length 6.5 to 8.5 mm.

Stage VII.—Shape and proportions of the appendages much as in the mature larva, but slenderer and the posterior ones less closely applied to each other. The first, second, third and fifth pairs curve backward, the seventh and eighth forward, the tenth pair is just visible from above. Clothing of the horns more modified than before. The fine brown branching secondary hairs are thick, especially along the anterior edges of the long horns; the coarse pale hairs are still present about as before on the basal pieces and short horns, but on the long horns outwardly reduced in number and partly converted into long pale setæ irregularly spinulated toward the tip on one side. Lateral tubercles with a bare tip, from which arises the primitive seta, surrounded by a circle of stiff hairs. Color brown, the horns darker, a pale gray line up the middle of each, furcate on the basal pieces; subventral edge white. The long white hairs are on the posterior edge of the horns, away from the greatest number of fine brown hairs. Length 8 to 10 mm.

Stage VIII.—All pale whitish brown with scarcely any marks. Hair clothing almost exactly as before, except for the addition of a few black, club-shaped spinulated hairs (Plate VIII, fig. 12) on the long horns. Seta ii of subdorsal row on the long horns arises from a bare cone surrounded by a brush of little black spines. Lateral row well

spined, but the spines all simple, the seta from a bare cone as before. The coarse setæ on the horns still present, rather less in number than before, and the fine branched hairs are more numerous. The long horns bear six kinds of hairs in this stage: (1) the primitive setæ, (2) the smooth pale setæ, (3) the long pale spinulated hairs, (4) the fine felted secondary hairs, (5) the club-shaped black hairs and (6) the fine spines on the tip. Length 10 to 13.5 mm.

Stage IX.—(Plate VIII, figs. 5, 6 and 7) Shape as described above. The third, fifth and seventh pairs of appendages longest, second and eighth next, first, fourth, sixth and ninth short. The side view (Plate VIII, fig. 6) shows how these may be variously elevated by the larva. The body is sparsely clothed with fine dark setæ (Plate VIII, fig. 15), the appendages both of subdorsal and lateral rows covered only with the fine branched secondary hairs (Plate VIII, fig. 11). The primitive setæ remain and at the tips of subdorsal horns a circle of very short black branched hairs (Plate VIII, fig. 10). These are absent on the side horns (Plate VIII, fig. 8). The black club-shaped hairs also remain, irregularly scattered toward the tips of the long horns; but all of the stiff pale setæ are absent. Any of the appendages of either row may be detached by slight force. They leave a bare area, and the subdorsal ones show a double attachment (Plate VIII, fig. 9) corresponding to setæ i and ii. The larva is quite uniformly colored, varying from tan color to purplish brown. The subventral edge is usually broadly white and the sides and under sides of the horns darker than the upper surface. The fine hairs on the horns are so dense and closely felted that they give the shape to the appendages as shown in the figures 5, 6 and 7. Length of larva 13.5 to 22 mm.

Cocoon.—As usual except that as all the tubercles are shed at the time of spinning, they remain on the outside of the structure and give it a characteristic appearance.

Food-plants.—Various low shrubs and the lower branches of trees. I have records of oak, chestnut, sassafras, dogwood and ash.

EXPLANATION OF PLATE VIII.

Fig. 1. Diagram of stage I, side view, showing the arrangement of the setæ.
" 2. Stage I, two-thirds view × 17.5.
" 3. Stage III, dorsal view × 10.
" 4. Stage V, dorsal view × 5.
" 5. Front view of mature larva enlarged.
" 6. Side view of same.
" 7. Dorsal view of the same × 2.5.

Fig. 8. One of the warts of the lateral row enlarged.
" 9. One of the long horns (detached) of subdorsal row, enlarged, ventral view, showing the double attachment.
" 10. The terminal seta (ii) and the area immediately around it from the tip of one of the long appendages.
" 11. One of the branched secondary hairs of the thick coating of the appendages 175.
" 12. Apex of one of the club-shaped hairs which remain on the long appendages in the last stage × 200.
" 13. Male moth, *Phobetron pithecium*.
" 14. Female moth, " "
" 15. A group of the skin setæ with their tubercles.

Sisyrosea textula HERRICH-SCHAEFFER.

1854—*Limacodes textula* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 184.
1864—*Isa textula* PACKARD, Proc. Ent. Soc. Phil. III, 347.
1867—*Limacodes inornata* GROTE & ROBINSON, Ann. Lyc. Nat. Hist. N. Y. VIII, 372.
1876—*Sisyrosea inornata* GROTE, Can. Ent. VIII, 112.
1882—*Sisyrosea inornata* GROTE, Check List, 17.
1891—*Isa inornata* DYAR, Ent. News, II, 156.
1891—*Isa inornata* SMITH, Check List, 28.
1892—*Sosiosa textula* KIRBY, Cat. Lep. Het, I, 551.
1894—*Sisyrosea inornata* NEUMOEGEN & DYAR, Journ. N. Y. Ent. Soc. II, 70.

LARVA.

1869—HARRIS, Ent. Corresp. pl. ii, fig. 7; pl. iii, fig. 6.
1887—HULST, Ent. Amer. III, 66.
1889—DYAR, Can. Ent. XXI, 77.
1893—BEUTENMUELLER, Bull. Amer, Mus. Nat. Hist. V. 89.
1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 97; pl. iv, figs. 13, 14.
1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 219.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space narrow, especially centrally, lateral space broad, very oblique, subventral space very small, retracted; form much flattened, the principal part of the visible surface consisting of the lateral spaces. Outline elliptical; subdorsal ridge slight, lateral pronounced. Horns of both ridges extended laterally, those of the subdorsal ridge reduced in size, flattened, subequal, those of joints 8 and 10 slightly shorter. Lateral horns produced and flattened, slender, fringing the sides and touching the leaf when the larva is at rest, subequal, those of joints 13 slightly longer. The spines on the horns are of the normal stinging type after stage I, but not strongly developed and they tend to degener-

ate in the later stages, their piercing caps being partly replaced by setæ. Those on the red anterior edge are shortened and darkened by black pigment. The arrangement of the horns is normal for the spined Eucleids, a single segmentary subdorsal row on joints 3 to 13 and single lateral row on joints 3, 4, 6 to 12. In stage I the horns are surmounted by a central swollen-tipped seta and a small series arranged around it in a radiating circle. Skin covered by a series of curious wavy folds which extend on the horns also, but less distinctly. This structure is unique and its origin obscure, though it seems to be produced by the ordinary skin granules becoming concave and their raised edges confluent.

Depressed spaces represented by whitish rings with dark centers, fairly well developed; (1) and (2) are situated closely in line in the small dorsal space, both paired; (4) and (6) are situated on the posterior half of the segment in the lateral space in two small areas devoid of green pigment, which are connected narrowly along the incisure; (5) is small and round, situated below (6) just above the base of the lateral horn toward the front edge of the segment. Subventral space without distinct marking. The spiracle on joint 5 is situated above the line of the lateral horns, nearly uniform with the white spots (5); those on joints 6 to 12 are below the horns, well hidden in the retracted subventral space. No caltropes or detachable spines are present. This highly specialized larva departs widely from its congeners in many respects. Its form is unique and its skin structure much more specialized than any of the other spined Eucleids. The horns are nearly equally developed, and in this respect the larva is more generalized than its allies, as also the presence of more than three setæ on the horns in stage I, indicating less advance in the degeneration of this stage. The peculiar lateral direction of the horns is somewhat paralled in *Phobetron*, though this does not indicate any close relation between these insects, since the hairs are in one case primitive setæ and in the other degenerating spines. The coloration is protective, and together with the peculiar shape enables the larva to escape observation to a sufficient extent.

AFFINITIES, HABITS, ETC.

With the possible exception of *S. nasoni*, the larva of which is unknown, the present species has no near allies in our fauna. Belonging as it does to the spined Eucleids, its origin may be traced to the South. Not improbably this type of larva will be found to occur in the tropics of America, but at present I know of none.

S. textula is single brooded. The moths emerge rather late in the

season—during July. The eggs are laid singly and well scattered. The young larvæ after emergence from the egg rest at the edge of the leaf on the under side and moult at once without feeding. During their life history they remain on the under side of the leaves, finally falling to the ground to spin their cocoons during September. They occur on forest and shade trees, not usually on very low bushes.

There are eight larval stages normally, occasionally nine, the extra stage being interpolated between the last two as in *Euclea*.

The present life-history was worked out from a newly hatched larva which I found on a white oak leaf at Bellport, Long Island, resting beside its egg shell.

Criticism of Previous Descriptions.

Harris' figures are good. In the colored one the yellow subdorsal line is omitted, while in the structural one the thoracic region is not properly segmented. Dr. Hulst describes the *head* as "strongly bifid, etc.," evidently referring to the anterior edge of joint 3; otherwise the description is excellent. In my own first general description I omitted to mention the subdorsal horns. In my later one I located the second and third subdorsal pair too far forward (they are on joints 4 and 5, not on 3 and 4 with a gap at 5 as I stated), and I mistook the lower lateral segmental glandular dots (5) for spiracles on joints 6 to 12, thus placing them above, instead of below, the lateral horns. Mr. Beutenmueller locates the red marks on segments 8 and 10 instead of 9 and 11, probably owing to a failure to recognize the true relations of the anterior horns. Dr. Packard treats this species with unusual brevity, confining his remarks to an explanation of the figures of the spines of the lateral horns. Yet, curiously enough, an error has crept in, for the figure is stated to represent "one of the lateral tubercles of the first abdominal segment" (joint 5), which really bears no lateral horn at all.

The attention given to this curious larva heretofore is far less than it deserves. The early stages are entirely unnoticed.

Description of the Several Stages in Detail.

Egg.—Elliptical, flat, reticulations distinct in the empty shell, linear, triangular, quadrangular, rarely pentagonal, irregular; transparent, colorless, the shell white; size $1.6 \times .9$ mm. Laid singly on the under side of a leaf.

Stage I.—(Plate IX, fig. 1) head whitish, eye black; body elliptical, dorsal space broadest anteriorly, gradually narrowed to the tail, not

narrower centrally. Segments fairly well marked; skin perfectly smooth. A subdorsal and a lateral row of thick processes with an apical seta and radiating crown (Plate IX, fig. 2) the terminal half of each more slender than the basal half and with an enlarged tip. There are eleven of the horns in the subdorsal row (joints 3 to 13) and nine in the lateral row (joints 3, 4, 6 to 12), all about alike in size. The subdorsal row stand at about 45° with the body, the lateral row are horizontal. Color whitish, a faint, more opaque yellowish tint on joints 6 to 9 centrally. Length 1.1 mm. The larva does not feed.

Stage II.—Horns shaped much as before, but covered with pale, black-tipped spines with swollen bases as in the mature larva (Plate IX, fig. 6), but only about twelve on each horn. Skin finely clear granular. Dorsal depressed spaces (1) double, small and round. Horns of subdorsal row all alike; those of lateral row on joints 3 and 4 a little longer than the rest, the apical spine setiferous. Dorsal space rather broad, even, rounded at joint 3; lateral space rather large, diminishing at the ends; subventral space very small. Ridges marked by the moderate rounded horns, the subdorsal row projecting rather more than 45°, but not horizontal. The larva is not greatly flattened, both the ridges being prominent. Under a high power the skin appears creased shagreened, almost scaly, uniform. Color ground glass white, immaculate, except the black tips of the spines. Length 1.1 to 1.8 mm.

Stage III.—Elliptical, gently flattened; dorsal space rather narrow, of even width, lateral space broad, oblique, diminishing at the ends; subventral space small, contracted. Horns subequal, slender, tapering, conical, the subdorsal ones extending at about 60°, the lateral horizontal; spines slender, short, with small black tips. The subdorsal horn on joint 13 and the lateral ones on joints 3 and 4 are a little larger than the others. Skin closely shagreened, as if the granules were appressed and concaved instead of convex as usual. Color light yellowish green, the horns paler; a pale yellow line along the subdorsal ridge, straight, faint at the ends, the pair connected by a faint bridge on joint 9. Length 1.8 to 3 2 mm.

Stage IV.—Elliptical, flattened; subdorsal horns considerably shorter than the lateral ones, all slender, tapering, the pair on joint 13 larger. Dorsal space narrow, a little wider at both extremities. Color pale green, a faint yellow line along the subdorsal ridge with a little red dot in the bridge at joint 9. Horns paler, the subdorsal on joint 3 and lateral on 3 and 4 have reddish tips. There is some light green pigment in the dorsal space, supplementing the color of the blood. An

obscure raised area down the anterior side of each segment; lateral depressed spaces (4) and (6) show as white dots. Dorsum evenly shagreened, the white paired dots (1) visible on joints 3 and 4, and 4 and 5. Length 3.2 to 4.4 mm.

Stage V.—Similar to the mature larva in shape, subdorsal horns projecting horizontally, only half as long as the lateral horns, those on joints 8 and 10 slightly shorter, that on joint 13 longest; all slender, fringed by the black-tipped spines. Skin wrinkled shagreened, the horns also wrinkly. Yellowish green, the yellow subdorsal line broad, a red dot on joint 9 anteriorly. Subdorsal horns of joint 3 and lateral of 3 and 4 red throughout, the subdorsal pair on 3 connected by a faint red line. Other subdorsal horns yellowish green, the one on joint 9 more distinctly yellowish. Lateral (4) and lower intersegmental lateral (6) dots visible as before. Length 4.4 to 6 mm.

Stage VI.—Flattened, dorsal space narrowed centrally at joints 7 to 11. Subdorsal horns one-third the length of the lateral ones, those on joints 8 and 10 shorter, all flattened, projecting horizontally. Color green, the dorsal space pigmented. Dots of depressed spaces (1) double and paired on joints 3 to 4, elsewhere scarcely indicated. On the sides a green line on the anterior side of the segments, the posterior part whitish and containing a large reniform glandular spot (4), a large round green centered one (6) and a small white dot (5) on the green band below. A yellow line on the subdorsal ridge, a central red dot on joint 9 surrounded by yellow. Anterior horns dark red as before, joined by a red stripe and armed by black spines. The other horns pale and armed as before. The black spines differ only in color from the others. Skin covered with long waved ridges instead of granules. Length 6 to 8.3 mm.

Stage VII.—Essentially as before, and also closely like the mature larva. Color green, a red dot on joints 9 and 11 anteriorly between the yellow subdorsal lines; front edge red as before with short black spines. Some of the spines of lateral horns bear long setæ instead of short tips, and thus cause a more fringed appearance. Length 8 to 12.6 mm.

Stage VIII.—(Plate IX, figs. 3, 4, 5 and 7) Shape as described above. Green, pigmented in dorsal space and on the raised bars along the anterior edge of the lateral segments. Glandular dots whitish, the spots on the sides (4) and (6) surrounded by some green pigment and appearing as broken whitish rings with dark centers. Anterior edge red, rarely also the tips of all the horns. A distinct yellow subdorsal

line running onto the horn of joint 13. Red marks on joints 9 and 10 usually broken into paired dots, sometimes supplemented by smaller dots on joint 12. Dorsal depressed dots (1) and (2) small, paired, distinct. Spines as before, the skin coarsely creased as in the previous stages. Length 12.6 to 18.5 mm.

Food-plants.—Chestnut, oak, beech, elm, maple, hop hornbeam, hickory and linden have been observed.

EXPLANATION OF PLATE IX.

Fig. 1. Larva in stage I, side view, enlarged.
" 2. One of the tubercles of stage I, further enlarged.
" 3. Mature larva, side view enlarged.
" 4. The same, front view.
" 5. The same, dorsal view.
" 6. Portion of the lateral area of one segment, showing the skin sculpture, the three depressed spaces (the upper one (4) only in part) and the lateral horn with its spines—enlarged; anterior side to the right.
" 7. Dorsal view of the mature larva showing all the depressed areas except (4), which are nearly completely hidden beneath the subdorsal horns.
" 8. Feeding traces of the larva on a black oak leaf, in stages II and III.
" 9. *Sisyrosea textula*, female.
" 10. The same, male.

ADDITIONS TO THE LIST OF LONG ISLAND SPIDERS.

BY NATHAN BANKS.

Since the publication of my list of Long Island spiders (Journ. N. Y. Ent. Soc., Vol. III, pp. 76–93), I have discovered several species not previously known from the locality, and a few species that appear to be new. These bring the total number of spiders up to 276. Almost as interesting as the discovery of a new form is that of a rare one. Of that little Oonipid, *Orchestina*, I now have several specimens of both sexes. *Gayenna fraterna* is now known to me by another ♂. Both sexes of *Agraeca minuta* have been taken not uncommonly in May and June. Another male has been taken of *Cornicularia minuta*. *Hyctia pikei* is not very rare on salt-grass at Bayville. The species new to the list are as follows:

DRASSIDÆ.

Prothesima, sp? An immature ♂ from among dead leaves in Oc-

tober. The cephalothorax and legs are pale-yellow; the anterior tibiæ rather blackish; abdomen pale, with black marks as follows: a basal band, a broad band before the middle, containing four pale dots, a narrow band beyond middle, and a large triangular spot before the tip, containing some small, pale chevrons; the first three bands are connected by a dark medium stripe.

AGALENIDÆ.

Cœlotes longitarsis *Em.*—Several specimens under leaves in Carpenter's woods, October.

DICTYNIDÆ.

Dictyna, sp?—Several specimens under rubbish on the beach, at Bayville, July. Perhaps it is *D. bostoniensis.*

THERIDIDÆ.

Spintharus flavidus *Hentz.*—Swept from herbage in woods, August; both sexes.

Theridium globosum *Hentz.*—In low herbage, June.

Teutana triangulosa *Walck.*—One specimen in the house.

Crustulina guttata *Reuss.*—Under dead leaves, June, July.

Ceratinopsis interpres *Cambr.*—Swept from an old field, June; several specimens.

Lophocarenum erigonoides *Em.*—In moss, October.

Tmeticus tridentatus *Em.*—Not uncommon under leaves in wet woods, October, November.

Tmeticus plumosus *Em.*—One ♂, October, under leaves.

Tmeticus flaveolus *Banks.*—In moss, October.

Tmeticus pallidus *Em.*—In moss, October.

Gonatium rubens *Blk.*—One ♂, in woods, October.

Microneta viaria *Blk.*—Under dead leaves, October.

EPEIRIDÆ.

Larinia borealis *Bks.*—A fine ♀ of this northern spider was taken from a mud-dauber's nest, in June.

Eugnatha straminea *Em.*—Mill Neck, sweeping, May.

THOMISIDÆ.

Philodromus, sp.?—Two young specimens were taken from a pine tree at Bayville, perhaps *P. robustus* Em.

LYCOSIDÆ.

Lycosa carolinensis *Hentz.*—In old fields, June.

Lycosa ocreata *Hentz.*—In fields, June; some are very pale, others very dark colored.

Pardosa brunnea *Em.*?—One ♂ from Mill Neck; the palpus is like this species, and the legs are properly marked, but the cephalothorax and abdomen are wholly dark, and very hairy.

Pardosa littoralis, sp. nov.

Length, ♀ 6 mm., ♂ 5 mm. Cephalothorax pale yellowish, with a black seam on posterior sides, eyes on black, a broad, brown, straight stripe from each dorsal eye to the hind margin, leaving a pale median area broader in front; clypeus and mandibles pale; legs pale yellowish; sternum and venter pale, each with a median dark stripe, abdomen dark brown above, a pale yellow basal spear-mark, and behind this are two rows of geminate pale spots. In the ♂ the stripes on the cephalothorax are broader and black; the clypeus and mandibles dark; the palpi all black; the femora mostly black, except at tips; the abdomen, above and below, and the sternum, black; a few pale spots on the bases of hind coxæ. The cephalothorax is not very long and not much narrowed in front, the legs are rather short, with two pairs of long spines under the anterior tibiæ and metatarsi. The epigynum shows a triangular depression, one and a-half times longer than broad, with rounded corners, and a narrow median finger which broadens in the posterior third to occupy nearly the whole cavity. The male palpus, from the side, shows three, black, rounded projections, the lower one the smallest.

Several specimens from a salt marsh near Mill Neck, in June.

OXYOPIDÆ.

Oxyopes salticus *Hentz.*—From an old field, June.

ATTIDÆ.

Attus palustris *Peck.*—One specimen, Mill Neck, October.

Icius diminutus, sp. nov.

Length, ♀ 2.6 mm. Cephalothorax rather shining yellow-brown, eye-region darker, iridescent; mandibles, sternum and legs yellow-brown, tarsi rather paler; abdomen brown above and below, with many scattered pale dots, and a distinct white band around base. The cephalothorax is rather low, with parallel sides; eye-region very short, very much broader than long, as broad behind as in front; legs short, anterior pair not much stouter than others, hind metatarsi spined only at tip, anterior coxæ separated by more than width of labium; sternum pointed behind. The epigynum shows, in a triangular area, two inverted horseshoe-shaped marks.

One female, Bayville, June, under dead leaves. Readily known by its small size, and white basal band.

Saitis minusculus, sp. nov.

Length, ♀ 2.3 mm., ♂ 2 mm. Cephalothorax reddish brown, blackish in eye-region; mandibles whitish; legs pale, prominently banded with black, except the anterior femora in the ♀ which have a dark stripe each side, and the femora and anterior tibiæ of the ♂ which are wholly dark; sternum brown; abdomen in the ♂ black, above and below, in the ♀ gray, with two rows of small, indistinct pale spots above; venter whitish with three parallel dark stripes; body mostly clothed with fine white hair; ♂ palpi snow white. Eye-region plainly less than thoracic region, broader in front than behind; legs short, third pair about as long as fourth; hind metatarsi spined at middle and tip; anterior coxæ separated by more than width of labium. The epigynum shows two large, connate circular spots; the ♂ palpus has apparently no projection or a very small one, to the tibia, the bulb is large, transversely divided, part of the basal half dark colored, a short straight style at the end of the upper half.

One ♂, one ♀, and one young ♂, under leaves, Sea Cliff, N. Y., May. Easily recognized by its small size, banded legs, and white palpus of the ♂.

A NEW SPECIES OF GOMPHUS.

By NATHAN BANKS.

Perhaps the first thing to do in describing a species of *Gomphus* as new is to apologize for doing so. Specimens of this species have been sent to me several times during the past few years, and I have been unable to fit it to any of the numerous species. To several of them it is closely allied, yet appears to differ from them more than some of them differ from each other.

The species of the genus *Gomphus*, as restricted, can be arranged in several groups. One, the one in which this new species would fall, may be characterized as follows: apex of ♂ abdomen not dilated, tenth segment black above; no spines on the vertex of the ♀. In this section would fall *G. parvulus*, *fluvialis*, *amnicola*, *lividus*, *albistylus*, *nævus* and *brevis*. The new species, which is from Ithaca, N. Y., is readily separated from *G. parvulus* by several characters, such as larger size, wholly pale front, the markings on thorax, etc. In *G. fluvialis* the ninth segment of the ♂ is nearly four times as long as the tenth; in the Ithaca species it is about twice as long; *G. fluvialis* also differs in the shape of the front, in various markings, and in shape of the ♂ appendages. *G. amnicola* is compared to *G. fluvialis*. The appendages are stated to be the same; no mention is made of a difference in the length of the tenth segment from that species; a longitudinal ridge

is mentioned on the center of the vesicle; none is seen in the Ithaca species; the basal fascia of the front is said to be triemarginate, such cannot be affirmed of the new form; nor has the latter a black margin on the labrum, and the dorsal carina is not unusually high. However, *G. amnicola* must be more closely related than any of the preceding species. *G. lividus* differs considerably in markings, etc.; it is, rather, a southern species.

To the other three species, *G. brevis*, *albistylus* and *nævius*, the Ithaca form is closely allied. The last two of these are known only from the female. But they are all too small; *G. albistylus*, which is the largest, has the abdomen of 29 mm. long; in the Ithaca species it is 33 to 35 mm. long. *G. albistylus* has various black markings around front and mouth-parts, also a yellow spot in middle of vertex, these not present in the new species; besides the prothorax is differently spotted, the stripes on the dorsum of thorax different, different abdominal markings, and the vulvar lamina is different. *G. nævius* is similar to the preceding species, but the vulvar lamina is still shorter and rounded at the tips; this species is still smaller, abdomen only 25 mm. long; other differences the same as in *G. albistylus*. *G. brevis* has the abdomen 26 mm. long, the pterostigma pale yellow, various markings on front and near mouth, in the ♂ a tooth behind the eye near the occiput, the border of occiput straight; none of these apply to the Ithaca species, nor will the markings on thorax and abdomen agree with it.

Gomphus descriptus, sp. nov.

Abdomen ♂ and ♀ 32 to 35 mm. long (exclusive of appendages). Hind wing 30 to 31 mm. long. Pterostigma yellow brown, about 3 mm. long, over 3 to 4 cells in ♂, over 5 in ♀; two rows of discoidal cells; 12 to 14 antecubitals, 10 to 11 postcubitals. Front and mouth-parts uniform greenish, except brown tips to mandibles, base of front above narrowly black; vertex black, sometimes pale near base of occiput; occiput yellowish ciliated with black; behind eyes yellowish, black toward occiput vesicle rounded, slightly rounded and elevated at each end; border of occiput in ♀ slightly concave in the middle, in ♂ wholly and evenly convex; no spines on vertex of ♀. The prothorax black, a long spot in front, a double one in middle, and a larger one on each side yellowish. Thorax greenish, more yellowish behind, with dark brown stripes as follows: a median one, bifid behind where the carina parts, wider in front, narrowly reaching the front margin, and thus connecting to the antehumeral; there is always a little portion of the dorsal carina, in front of its highest point, yellow; a broad antehumeral stripe projecting inwards above, connecting above to the narrower humeral stripe, and sometimes below, leaving only a short green line; a line on sides before the stigmata, bent above; another line on the posterior suture. The anterior femora are usually greenish behind, and in the ♀ the posterior ones in front. The abdomen is black, in ♂ there is a yellow stripe above on 1 and 2, a line, often not reach-

ing the ends of the segments, on 3 to 7, sometimes on base of 8; membrane at base of 9 and 10 yellow; sides of 1 yellow, and of 2, except behind the ears and on posterior margin; yellow on base of 3; sometimes on 4 to 7 a basal spot, and sometimes an apical one on 7; sides of 8 mostly yellow, with a projection above; border of 9 yellow, and lower apical portion of 10; 10 about one-half as long as 9; appendages black; superior pair longer than 10, divaricate, acute at tip, at half their length on inner side below is a large sharp pointed tooth; inferior pair but little shorter, and with the branches more widely divaricate, than the superior pair, upturned at tip. In the ♀, the dorsal stripe on 1 and 2 is much broader and the sides of 1 and 2 wholly yellow; on the sides of 3 to 7 is a long yellowish mark with its tip turned down, on most of the segments the basal portion of this mark is separated from the rest; sides of 8 yellow, with projections upward; sides of 9 and 10 yellow, and a narrow median stripe above on 10; superior appendages black, rest yellowish; vulvar lamina black, one-third as long as 9, apical half bifid and divaricate, the tips acute.

Described from six males and two females, collected at Ithaca, N. Y., and sent me by Mr. MacGillivray; May 21, 1890; May 15, 1894; May 18, 1895.

A SHORT REVIEW OF THE CHRYSOMELAS OF NORTH AMERICA.

BY MARTIN L. LINELL.

The following attempt at a synopsis of the species entered in our check-list under the generic names of *Doryphora* and *Chrysomela*, is based principally upon the material in the U. S. National Museum, but I am also greatly indebted to Messrs. Schwarz and Hubbard and Mr. H. Ulke for access to their extensive collections as well as for valuable information.

The genera may be separated as follows:

Last joint of palpi short, truncate.

Mesosternum prominent, tuberculiform between the coxæ. Anterior femora of male strongly toothed..... .....**Labidomera** *Chevrolat.*

Mesosternum not surpassing the level of prosternum. Femora simple.

Leptinotarsa *Stål.*

Last joint of palpi not shorter than penultimate.

Claws parallel, connate at base .....**Zygogramma** *Chevrolat.*

Claws divergent.

Sides of thorax not incrassate. Elytra with darker markings limited by impressed punctures.....**Calligrapha** *Erichson.*

Sides of thorax incrassate. Elytra not maculate....**Chrysomela** *Linnè.*

Genus **Labidomera** *Chevrolat.*

Contains only *L. clivicollis* Kirby, and its variety *L. rogersii*

Leconte. It is dark blue, elytra reddish yellow with typically a common large cruciform post-scutellar spot, an elongate triangular humeral spot and a V-shaped subapical. The humeral and scutellar spots are often confluent, forming a broad transverse band. The variety has the spots broken up into smaller ones and occurs principally in Texas and Kansas.

Genus **Leptinotarsa** *Stal.*

Elytra unicolorous.

Reddish yellow; antennæ, palpi, legs and scutellum black; elytra punctate in subgeminate striæ. (Tex., N. Mex., Ariz., Mex.)
L. rubiginosa *Rogers.*

Dark cupreous green, very large; elytra densely confusedly punctate; intervals aciculate. (Southern Calif., Mex.) ..... **L. behrensi** *Harold.*

Black; elytra green or blue, finely irregularly punctate. (Tex., Ariz., Mex.)
L. haldemani *Rogers.*

Elytra vittate.

Thorax immaculate.

Æneous; elytra yellow, irregularly bigeminately punctate, with four interrupted æneous vittæ. (Tex., Ariz., Mex.) .... **L. lineolata** *Stål.*

Æneous black; ventral surface and legs pale; elytra regularly striate with a narrow dorsal and a marginal vitta yellow. (Tex., Mex.)
L. dahlbomi *Stal.*

Rufescent; elytra pale, with suture, two discal vittæ and margin piceous. (Lower Cal., Ariz. Collection Ulke.) .... **L. peninsularis** *Horn.*

Black; elytra pale, regularly striate, each with four dark vittæ. (N. Mex., Mex.) ..... **L. melanothorax** *Stal.*

Thorax maculate.

Ventral surface and legs entirely black.

Elytra with suture, five vittæ and epipleura black; striæ of confused punctures. (Southern Calif., Mex.) **L. undecimlineata** *Stal.*

Ventral surface and legs yellow, maculate with black.

Elytral striæ of confused punctures; suture and five vittæ black.

Epipleura pale ..... **L. decemlineata** *Say.*

Epipleura black towards apex (Agua Negra, Tex., Mex.)
L. multitaeniata *Stål.*

Elytral striæ regular, punctures in single rows; epipleura pale.

Elytra each with five vittæ, third and fourth approximate, often united. (Southern States west to Kansas.)
L. juncta *Germar.*

Elytra each with four vittæ, more or less abbreviated, third and fourth not approximate. (Brownsville, Tex., Mex.)
L. defecta *Stål.*

Genus **Zygogramma** *Chevrolat.*

Thorax brown with anterior angles pale; intervals of elytra punctate.

Oval, brown; elytra pale, with the epipleura, suture and four vittæ black or brown, the first vitta free; the second interrupted near apex, leaving a

free spot; the fourth strongly abbreviated, with a free spot at the middle of the sides. (Southern States to Mont. and Ariz.

Z. exclamationis *Fabricius.*

Oval, brown, smaller; elytra pale, with sutural and subsutural vittæ confluent, the second and third joining at two-thirds the length, a free spot near apex and a very short fourth vitta behind the humerus; epipleura pale. (Kans., Neb., Mont., Dak.) ..... **Z. conjuncta** Rogers.

Like previous form but generally paler in color and the elytral vittæ broken up into spots. (Kans., Dak., Mont.) ..... **Z.** var **pallida** *Bland.*

Oval, brown, of medium size; elytra pale with brown vittæ, the subsutural united with the sutural; two broad discal vittæ generally connected near apex the fourth vitta entirely wanting; epipleura and the margin posteriorly brown. (Ariz., N. Mex., Colo., Utah) ..... **Z. continua** *Leconte.* (syn. *fasciatipennis* JACOBY.)

Thorax unicolorous, brown or æneous.

Globosely oval, brown, slightly bronzed; elytra pale with dark vittae; subsutural united with sutural, two confluent discal vittæ, no isolated spots. epipleura pale with dark margins. (East of Rocky Mts.).

Z. suturalis *Fabricius.*

Like previous form, but the subsutural and discal vittæ free, var. **casta** *Rogers.**

Globosely oval, brown, slightly bronzed; elytra pale with narrow vittæ; the subsutural free, slightly abbreviated; the second and third sinuous, abbreviated and united at two-thirds the length; the fourth very short, confluent at base with the third; two or three isolated spots posteriorly; epipleura pale with brown margins. (Tex., Kans., Ariz.)

Z. disrupta *Rogers.*

Like previous form, but smaller and still more globose; the second vitta twice interrupted, the fourth represented by a spot only. (Tex., Col.)

Z. heterothecæ sp. nov.†

Oval, dark æneous; elytra pale with a sinuous vitta extending from the humerus to near the suture one-fourth from apex, thickened at middle, hooklike at apex and with a short humeral stripe attached to its base; an oval spot near the scutellum and three smaller ones posteriorly near the lateral margin; sutural vitta striatopunctate, trifid at base; epipleura and margin pale. (Tex.; Southern Ariz., Mex.) ..... **Z. malvæ** *Stål.*

Oval, ferruginous; elytra yellow with markings as in *Z. malvæ*, but subsutural vitta free for at least half the length and the epipleura margined with brown. (Ariz., N. Mex.) ..... **Z. tortuosa** *Rogers*

Oval, brown, more or less bronzed; elytra pale with a broad sutural vitta, ramified before and behind the middle, a broad arcuate band from the

* *Chrysomela festiva* FABRICIUS. "Nigroænea, elytris lineis tribus suturaque antica flavis. Statura *C. fastuosæ* at duplo minor. Habitat America." Suffrian suggests that this may be identical with *casta* Rogers, but I can not see that the description fits this or any other North American species.

† Mr. E. A. Schwarz informs me that he collected this species in abundance at Columbus, Texas, feeding on the leaves of the Composite plant, *Heterotheca scabra*.

humerus to behind the middle, a small round spot on the side of the disc and another one near apex; epipleura and an elongate marginal spot just behind the middle also dark. (Southern Ariz.).....**Z. opifera** *Stål.*

Elongate oval, feebly convex, brown, slightly bronzed; elytra pale with a broad sutural vitta, epipleura and spots æneous; two larger basal spots, the exterior one emarginate behind, a small spot at the suture before middle, a larger one, strongly arcuate, behind the middle and many smaller ones posteriorly. (Tex., N. Mex., Ariz.).....**Z. piceicollis** *Stål.*

Elongate oval, feebly convex, greenish black. Elytra pale; epipleura, a broad sutural vitta, twice ramified posteriorly, an oblique humeral vitta, connected with the sutural band at middle, an oval spot between humerus and scutellum, four or five discal spots on posterior half and the lateral margin behind the middle, æneous. (Mex., Ariz. Collection Ulke.)

Z. signatipennis *Stål.*

Genus **Calligrapha** *Erichson.*

Elytra vittate.

Thorax uniformly brown. Epipleura dark.

Oval, ferruginous. Last joint of palpi strongly dilated. Sides of thorax coarsely punctate. Elytra yellow with broad sutural and discoidal ferruginous bands; the latter longitudinally more or less divided by yellow. (East of Rocky Mts.).....**C. lunata** *Fabricius.*

Oval, convex, brown, slightly bronzed. Elytra pale with a broad sutural and dorsal vitta bronzed, the latter angularly incised at middle exteriorly. (East of Rocky Mts.).....**C. similis** *Rogers.*

Like the preceding but globosely oval, with the sutural vitta truncate at base and dilated at apical third and the discal vitta abbreviated posteriorly. (Kans., Neb.).....**C. incisa** *Rogers.*

Regularly oval, convex, brown. Elytra pale; an entire sutural and two discal vittæ of subequal width and parallel, brown; the inner discal vitta somewhat shorter. (Capron, Fla.)..**C. cephalanthi** *Schwarz.*

Thorax brown with apical and lateral margin pale. Epipleura pale.

Oval, convex, dark brown. Elytra pale with sutural and one discal vitta brown, the latter abbreviated behind. (Kans, Neb.)

C. præcelsis *Rogers.*

Thorax pale with dark discal mark. Epipleura pale. Elongate oval, less convex, æneous black.

Elytra pale with sutural and one discal vitta black; the latter more or less sinuate exteriorly. (Atl. to Pac States.)....**C. elegans** *Olivier.*

As the preceding, but the discal vitta of elytra obliquely divided behind middle. (Los Angeles Co., Cal.)....var. **californica,** subsp. nov.

Elytra irregularly maculate.

Epipleura of prothorax not impressed.

Legs red, epipleura of elytra pale.*

* I have seen only a single specimen of *C. scalaris* (from Bethlehem, Pa.), with æneous epipleura.

Thorax entirely green.

Oval, green. Elytra pale with a broad, three or four times ramified sutural vitta; a larger curvate humeral and many smaller spots, one of which is placed close to lateral margin at middle. (East to Neb. and Tex.)

C. scalaris *Leconte.*

Like preceding but elytral markings narrow and subsutural stripe free. (Eastern States to Neb.) . . **C. philadelphica** *Linné.*

Markings broader, especially the humeral stripe. . var. **spireæ** *Say.*

Thorax pale, at least in part, lateral margin of elytra unspotted.

Oval ferruginous. Thorax pale with ferruginous spots. Elytra with numerous small black spots. (Mo. to Wash.)

C. multipunctata *Say.*

Oval, green. Thorax green or brown with pale apical and lateral margins. Elytra pale with slender sutural and subsutural lines and numerous small spots, green. (Eastern States to Ore.) . . . . . **C. bigsbyana** *Kirby.*

Legs and epipleura black.

Oval, convex, greenish black. Elytra with heavy black markings connected, and enclosing angular pale spots. (Canada.)

C. pnirsa *Stål.*

Epipleura of prothorax canaliculate.

Epipleura of elytra pale.

Oval, convex, bluish black. Elytra pale with narrow black markings; sutural, subsutural and two parallel sinuous stripes from the humeral region to beyond middle, the exterior one connected with a humeral spot; several smaller spots posteriorly. (El Paso, Tex., Ariz., N. Mex., Mex.) . . . . . **C. dislocata** *Rogers.*

Like the preceding but the markings of elytra much broader and the subsutural confluent with the sutural stripe. (Pac. States to Neb.) . . . . . **C. sigmoidea** *Leconte.*

Epipleura of elytra black.

Legs red.

Elongate oval, bluish black. Elytra pale with strong black markings; a sutural vitta trifid in front; a long stripe from the humerus arcuate towards suture before the middle, abruptly parallel with suture to behind middle and again arcuately bent and reflexed towards the margin; an oval spot between the humerus and scutellum, a V-shaped one at apex and several on the sides of the disc; also a marginal spot at middle. (Ariz., N. Mex.) . . . . . **C. serpentina** *Rogers.*

Legs black.

Very small, globosely oval, black. Elytra with a broad black sutural vitta, abreviated at base, and with about 9 large pale spots surrounded by black rings; a small marginal spot at middle. Kans. (Collection Ulke), Mex.

C. multiguttata *Stål.*

Size, form and elytral markings resembling *C. scalaris*, Leconte but lateral margin unspotted. (Mex.) (Ariz., *fide* Crotch.).....**C. sylvia** *Stål.**

Genus **Chrysomela** *Linné.*

Marginal groove of thorax not reaching to apex.

Ovate, green or blue, apterous. Elytra sulcate, finely punctate in regular striæ. (Alaska).....**C. subsulcata** *Mannerheim.*

Oblong, black, winged; elytra margined with fulvous, intervals irregularly punctate. (Colo., Kans., Neb., Dak.).....**C. flavomarginata** *Say.*

Like preceding but without yellow elytral margin. (Col. to Ore.) **C. basilaris** *Say.*

Marginal groove of thorax entire.

Oval, convex, winged, violaceous; elytra golden green or purple, more or less irregularly striato-punctate. (Tex. to Neb.).....**C. auripennis** *Say.*

Like preceding but entirely bluish black. (Tex., Idaho, Cal.) **C. inornata** *Rogers.*

Oval, bluish black, apterous. Lateral margin of thorax more incrassate and strongly rounded. (Rocky Mts.).....**C. montevagans** *Leconte.*

Globosely oval, æneous black, subopaque, winged. Elytra finely alutaceous between the punctures. (N. Y. to Fla., Tex. and Mo.) **C. subopaca** *Rogers.*

◆

THE DOG'S HEAD BUTTERFLY ON STATEN ISLAND.

By W. T. Davis.

In the "Canadian Entomologist" for last July and August the fact is recorded that *Colias cæsonia*, the Dog's Head butterfly, had been taken last June near Toronto and in Southern Manitoba. This southern butterfly has never been recorded from the vicinity of New York City and its name does not occur in any of the local lists. Its appearance during the past summer on parts of Staten Island is, therefore, of considerable interest. A single specimen was taken in June at Eltingville by Capt. Robert D. Wainwright, and on July 11th the writer saw quite a number flying across a sandy, over-grown field near Rossville. There was a strong wind blowing and very few of the butterflies tarried on the *Asclepias* flowers. The next day there was less wind and several were captured, though they were not so common as on the 11th. By the 25th of July they had ceased flying. It may be of interest to add that *Thecla titus* was common this year on the flowers of *Asclepias tuberosa* in certain sandy portions of the island.

*From Crotch's remarks (Proc. Ac. Nat. Sci. Phila., XXV, p. 50). I suspect that he has wrongly identified this species and that the *C. sylvia* of Stal does not belong to our fauna.

DIABROTICA IN NEW MEXICO.

The Table of the distribution of *Diabrotica* given by Prof. Webster on p. 67 has gone wrong either in copying or printing. The altitude of the Mesilla Valley is 3800 ft. *D. tricincta* was not taken at Juarez, but in the Mesilla Valley; Mr. Wickham says it is also found in Northern Arizona, and at Albuquerque, N. M. *D. longicornis* (not *lemniscata*) was found by Mr. Wickham, at Albuquerque. *D. lemniscata* is from Socorro (Snow). T. D. A. COCKERELL.

NOTE ON SAMIA CALIFORNICA.

BY A. R. GROTE.

Mr. Beutenmüller writes to me that, as to *Samia californica*, this name is the first published (1865) with description and must have preference for the species. Dr. Behr writes to Mr. Beutenmüller that the name "*ceanothi*" was by mistake left out of the original description, and that no such name as "*Samia rubra* Behr," to which specific title Neumoegen and Dyar give preference, was ever published by him. I stated in the "*Saturniiden*," that no description under the name "*rubra*" is known to me. The descriptions of the species under the name "*ceanothi*" (1868) and "*euryalus*" (1875) are both later than its description as *californica*: although the two first names were in use in collections, as it now appears, they were neither of them sanctioned by description at the time my original paper appeared.

NEW SPECIES OF INSECTS TAKEN ON A TRIP FROM THE MESILLA VALLEY TO THE SACRAMENTO MTS., NEW MEXICO.

BY T. D. A. COCKERELL.

From September 27 to October 7, 1896, the writer went on a trip to the Sacramento Mts., in company with Prof. C. H. T. Townsend. Among the insects obtained are several new species, some of which are described herewith:

COCCIDÆ.

Icerya (Crypticerya) townsendi, sp. nov.

♀. Long. 5, lat. 4, alt. 3.5 mm., subglobose, dark pink becoming dark purplish, thinly covered with white mealy secretion, which forms dorsal and sublateral

longitudinal series of wart-like white prominences. Viviparous (ovoviviparous), the young leaving the egg before being excluded from the body of the parent.

Legs and antennæ dark brown, the distal margins of the antennal joints broadly pallid. Antennæ 11-jointed, slender, joints 1, 2 and 11 subequal in length and longest, the others subequal and shorter, 3 about as long as broad; 4 and 5 shorter than 3 and broader than long, 5 shortest; 6 to 10 longer than broad. 3 may be as long as 2. Femur rather stout. Tibia longer than femur. Tarsus curved, about half as long as tibia. Claw pallid, broad, narrowing to a point. Mouth parts small.

Larva at period of hatching 1 mm. long, bright red, sparsely powdered with white meal, legs and antennæ black. Antennæ 6-jointed, 6 much longest; formula 6(21)·3(54). End of body with 6 long hairs on each side, of which the first three and last are about equal, and the other two very much longer. The two especially long ones are very close together.

Habitat: Mescalero Reservation, a short distance below the Agency, at base of stems of *Gutierrezia sarothræ*, October 2. *Orthezia nigrocincta* Ckll., occurred in numbers on the same plants. On July 26, 1892, Prof. Townsend found a single specimen of *Icerya* on *Gutierrezia microcephala* about 10 miles south of Navajo Springs, Arizona. I did not see the specimen which was sent to Dr. Riley, but it was very possibly *I. townsendi*.

A few weeks ago Prof. Townsend discovered at Mesilla an *Icerya* on stems of *Pluchea borealis*, while collecting *Phenacoccus helianthi*, which abounds on the same plant. This is larger than *I. townsendi* (long. 6.5, lat. 5.5, alt. 5 mm.), dark purplish grey, speckled with white secretion, with very distinct longitudinal rows of yellow-white mealy protuberances. These wart-like protuberances number about 8 in the dorsal row; the sublateral row is anteriorly single, of three, then giving way to two rows, of about 6 each. There is also a lateral row of about 9. The legs and antennæ resemble those of *townsendi*. On breaking open the body, I found a quantity of orange-yellow fluid, in which the larvæ had not yet reached the hatching stage, and so could not be compared with those of *townsendi*. This *Icerya* on *Pluchea* I propose to call *I. townsendi* var. *pluchea*, as its characters scarcely warrant us in regarding it as a distant species. *I. townsendi* is closely allied to *I. rosæ*; and especially, it would seem, to *I. australis*, which Maskell regards as a variety of *rosæ*.

It may be remarked here that *Icerya* (*Proticerya*) *rileyi* Ckll., was found in abundance on mesquite a few miles south of Tularosa; a new locality.

Dactylopius dasylirii, sp. nov.

♀. Length 4 mm. or slightly less, dark olivaceous, covered with white meal.

No lateral tufts, but sides very mealy; thick caudal tufts like those of *D. virgatus*, not very long. Antennæ very slender, 8-jointed. Formula 83(12)(456)7. All the joints longer than broad. 8 with three whorls of hairs. 3 very slender, nearly as long as 8. 1 longer than its breadth at base, 8 about or nearly as long as 6+7. Joints with sparse whorls of long hairs. Color of antennæ brown. Legs ordinary, small, slender, pale brown. Tarsus about half as long as tibia. Claw short, moderately curved. Tarsal digitules extremely slender, filiform, with minute knobs. Digitules of claw about as long as claw, stout, bulbous at base. Tibia with four strong bristles on outer margin. Caudal tubercles low, rounded, with a rather long bristle, some short bristles, and a couple of short stout spines. The ♀ does not stain the liquid in which it is boiled. Young larva light yellow.

Habitat: Organ, N. M., 5,100 ft., in great numbers at bases of leaves of *Dasylirion wheeleri*. The larvæ live at the extreme base of the leaf, which is pallid; the adults a little further up. This is a typical *Dactylopius*, and quite different from *D. olivaceus* Ckll., which lives "in cavities in leaves" of *Yucca*.

Dactylopius gutierreziæ, sp. nov.

♀. Slate color, small (when boiled and flattened under cover-glass, long. 2, lat. 1 mm.), forming a long firm snow-white ovisac, 4 to 6 mm. long, about 1 mm. broad, on the narrow leaves of the *Gutierrezia*.

♀. Elongato-oval, does not stain the liquid in which it is boiled; antennæ and legs pale. Antennæ 8-jointed, of the usual Dactylopiine type. Formula 812(37)(46)5. 5 is broader than long. 3 is conspicuously shorter than 2. 1 is very large. 8 has three whorls of hairs. Anal ring with the usual 6 hairs. Caudal tubercles very low, with the usual hairs, the longest a little longer than those of the anal ring. Legs ordinary. Trochanter with a rather short bristle. Tibia almost as long as femur, tarsus rather more than half as long as tibia. Claw small, not much curved. Tarsal digitules filiform, without knobs. Digitules of claw stout, but very short, shorter than claw.

Habitat: Mesilla Valley between Las Cruces and Organ, abundant on *Gutierrezia sarothræ*, var. Also abundant on *G. sarothræ* near the Muscalero Agency, at the type-locality of *Icerya townsendi*. This is not a typical *Dactilopius*, but is allied to such forms as *D. townsendi* and *D. steelii*. Its ovisac is exactly like that of *Phenacoccus*. It has a chalcidid parasite.

Ceroplastes irregularis *Ckll.*, var. **rubidus**, var. nov.

♀. Scale very dark madder red or pinkish-brown, with the short dorsal line of secretion showing up conspicuously white. Margin of waxy scale dull white. Boiled in caustic soda, the liquid is turned claret color.

Habitat: Whitewater, abundant on *Atriplex canescens*. At this time (beginning of October) the scales were full of the pink eggs. The dark pink-brown wax of this insect is very peculiar, and was perfectly constant in the locality, the typical form not being observed anywhere in the vicinity.

CECIDOMYIIDÆ.

Cecidomyia neomexicana, sp. nov.*

♂. Length 3 mm. Dark slate grey. Sutures of abdominal segments reddish two longitudinal hairy bands on thorax; abdomen hairy. Halteres dull white. Antennæ 2+12 jointed, very dark grey, sometimes pale; legs grey, paler. Wings greyish, venation normal; vii (following Comstock's nomenclature) very weak; fold representing v distinct, iii 2+5 reaching margin a little above tip of wing; lower margin with a fringe of hairs. Antennal joints elongate, cylindrical, not moniliform with sparse whorls of short hairs; joint 3 much longer than 4. Pupa-shell red-brown.

Galls numerous, many together, on twigs of *Atriplex canescens*; globular, 8 to 12 mm. diam., yellowish-white. Composed of loose felted hairs, so that the outside is soft, wool-like in appearance, yielding to pressure. The cell within is green, not at all woody. Flies issued from September 30 to October 1.

Habitat: Organ, N. M., 5100 ft. Also common on Tularosa Creek. The fly resembles *C. atriplicis*, Twns., but the gall is quite different. Prof. Townsend has known the galls of *C. neomexicana* for several years, but had failed to obtain the fly.

APIDÆ.

Perdita townsendi, sp. nov.

♀. Length about 7.5 mm., shining, fairly pubescent. Head dark prussian green, area between clypeus and antennæ black. Vertex, occiput and cheeks with conspicuous white pubescence, sides or front also pubescent. Front minutely granular, with sparse small punctures. Clypeus, sparsely but distinctly punctured, moderately high, rounded at top, notched. Eyes very dark brown. Clypeus except the usual black dots, lateral face-marks, two spots representing supraclypeal marks, scape except a black streak at and above, and basal half of mandibles, primrose yellow. Lateral face-marks shaped almost exactly as in *P. rectangulata*, but separated from clypeus by a black line, and the narrowing about level with the lower part of the antennal sockets, the linear upward extension very short. Flagellum dark sepia brown above, yellow beneath. Thorax with moderately dense white pubescence, shining dark greenish-blue or bluish-green, the mesothorax more green, the metathorax more blue. Mesothorax smooth, sparsely punctured; metathorax minutely granular, or rather tessellate. Tubercles and hind border of prothorax narrowly, very pale yellow. Tegulæ hyaline with a yellow basal mark. Wings milky-hyaline. Stigma and nervures colorless. Marginal cell with the poststigmatel portion slightly the longer. Second submarginal large, narrowed about half to marginal. Third discoidal distinct. Legs primrose yellow; patch on anterior and middle tibiæ behind, and hind tibiæ except extreme base, black. Small joints of hind tarsi darkened. Abdomen broad and flat, very pale yellow, with continuous brown-black bands, occupying the adjacent apices and bases of segments, 1–2, 2–3, 3–4, and 4–5, the first two of these four bands being broader than the others. Segment 1 has also its base black, leaving only a rather narrow transverse

* Mr. Coquillett refers C. neomexicana to *Asphondylis*, where I suppose *C. atriplicis* should also go. T. D. A. C.

band of light yellow, broken in the middle. Venter very pale yellow without marks. The mandibles are notched within near the end.

♂. Length about 6.5 mm. The yellow color darker; flagellum orange beneath. Margin of stigma and adjacent nervures brownish, marginal cell therefore very distinct. 3d discoidal excessively weak. Face all yellow beneath level of antennæ, except clypeal dots, and small triangles at junction of clypeus, supraclypeal mark, and dog-ear marks. Supraclypeal mark slightly notched or depressed in median line above, not at all produced upwards. Lateral marks running obliquely from antennal sockets to a point on the margin of the eye, forming an angle of about 45° thereat. Mandibles yellow except tips. Labrum yellow with a dark spot on upper border medially. Prothorax yellow with a dark transverse band. Legs wholly yellow, except a dark stripe on hind tibiæ, and dark last three joints of hind tarsi. Abdomen with five bands instead of four, some presenting square sublateral bulgings on anterior edge, not always obvious.

Habitat: White Sands by Whitewater, N. M. Many of both sexes found by Prof. Townsend visiting flowers of *Bigelovia*, October 6th. On the same day we found a purple-flowered *Aster* at Whitewater visited by *P. townsendi*, 1 ♂, 1 ♀, one *P. fallax*, Ckll., and one *P. semicrocea*, Ckll. The ♂ *townsendi* from the *Aster* has the abdomen more darkened, so that it might be said to be black with light bands.

P. townsendi is allied to *P. bigeloviæ*, but very distinct. The ♀ is larger, and the femora are entirely yellow, etc. In my table of *Perdita* (Proc. Phil. Acad., 1896) it runs down to 77. The ♂ in the table runs down to 42. ♂ *bigeloviæ* differs at once from it by the yellow of the face extending above level of antennæ in the median line.

Perdita stottleri, sp. nov.

♀. About 6 mm. long. Differs from *townsendi* in its small size, and in having the front femora with a large black patch behind, the middle femora with a black speck near the end, and the hind femora with the upper hind edge broadly black for the apical three-fifths. The clypeus is hardly so high as in *townsendi*, and the lateral face-marks run gradually to a point, the angulation being barely perceptible. The supraclypeal spots are present as in *townsendi*.

Differs at once from *bigeloviæ* by the pale yellow venter of abdomen, as in *townsendi*, that of *bigeloviæ* being dark brown. The abdomen above also is marked just as in *townsendi*. The femora in *bigeloviæ* are all black except at their distal ends, in *stottleri* only marked with black, in *townsendi* without any black.

Habitat: By Tularosa Creek at the store on the edge of the Mescalero Reservation, October 1st. One specimen on flowers of *Bigelovia graveolens* var. *glabrata*,* a few feet within the boundary-line of the

* The *Bigelovia graveolens* var., along Tularosa Creek is very attractive to flies. Prof. Townsend will report elsewhere on those of the families in which he is inter

reservation. The species is named after Lieut. Stottler, the Indian Agent, whose work among the Mescalero Apaches excited our strongest admiration. *P. stottleri* is very near to *townsendi* (which occurs on a different *Bigelovia*), but six ♀ *townsendi* were compared with it, and none show any tendency to intergrade.

Perdita chrysophila, sp. nov.

♂. Length 5.5 mm. Head and thorax very dark bluish green, scutellum and clypeus black, supraclypeal area æneous. Abdomen piceous-brown above and below, the hind margins of the segments rather broadly hyaline; apex orange. Labrum dark brown. Mandibles black with the tips dark rufous. Scape black, flagellum very dark brown. Tegulæ pale brown. Wings milky-hyaline; costal nervure, margin of stigma, and radial nervure sepia-brown; the other nervures pallid. Pubescence dull white. Legs piceous black, the tarsi becoming brown.

Head very large, subquadrate; cheeks unarmed, shining, not very pubescent. Front shining, microscopically tessellate, with distinct but very sparse punctures. Face tolerably hairy. Thorax shining, tolerably hairy. Mesothorax and scutellum with distinct but very sparse punctures. Metathorax shining, very obscurely sculptured. Marginal cell with its poststigmatal portion much the longest; its end squarely truncate. Second submarginal narrowed more than half to marginal Third discoidal excessively weak or wanting.

Habitat: Organ, N. M., 5100 ft., September 28th, on flowers of *Verbesina encelioides*, one taken others seen. Near to *P. arcuata* Fox, to which it runs in table of *Perdita*, but it does not have the pale color on mandibles and anterior tibiæ.

Two other species of *Perdita* were taken on the trip, namely: *P. albovittata*, Ckll., Parker's Well, October 7th. Three ♀ ♀ visiting flowers of *Baileya multiradiata*.

P. sphæralceæ Ckll. Whitewater, October 6th, one ♀ on *Sphæralcea angustifolia*. Organ, September 28th, three ♀ ♀ at flowers of *Mentzelia*, with no *Sphæralcea* near. The occurrence of this species on *Mentzelia* is contrary to all previous experience, and surprised me much.

I will take this opportunity of stating that the flowers visited by *P. callicerata* and *P. solitaria* have now been examined with care; the former visits *Baileya multiradiata* at Las Cruces, the latter *Pectis pappposa* in Soledad Cañon.

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ested, but I may as well give a list of determinations just received from Mr. Coquillett through Mr. L. O. Howard. (1) On the *Bigelovia* at store below Agency, with *Perdita stottleri*: *Exoprosopa* sp., *Phorbia* sp. (2) On the *Bigelovia* at camp just below Agency, Oct. 2: *Sparnopolius fulvus* Wied., *Phthiria diversa* Coq., *Lordotus diversus* Coq., *Exoprosopa caliptera* Say, *Anthrax syrtis* Coq., *Odontomyia nigrirostris* Loew, *Pegomyia communis* Walk., *Sapromyza vulgaris* Fitch, and *Sarcophaga* sp. Mr. Linell has also identified an *Œcanthus*, which was rather common on the *Bigelovia* just below the Agency, October 2d, as *Œ. fasciatus*. T. D. A. C.

ALEURODIDÆ.

Aleurodes berbericola sp. nov.

Empty pupa-case .75 mm long, oval, colorless, without a fringe, margin radiately striate; vasiform orifice an elongated triangle, the base cephalad, the sides nearly twice as long as the base; operculum hemispherical or semilunar, its base being concave; lingua elongate subspatulate, extending nearly as far beyond the operculum as the breadth of the latter, but not to the tip of the orifice. No conspicuous submarginal orifices.

Adult ♀ .60 mm. long, anterior wing 1.25 mm. Head and body entirely deep orange yellow, legs pale lemon yellow, wings pure white without marks. Eyes jet black, each one completely divided. Genitalia ordinary, the usual two bristles on each side of the end of the abdomen.

Habitat: On a shrubby *Berberis*, the pupæ on the leaves, the adults flying about the plants. Mescalero Reservation, Tularosa Creek, below the Agency, October 2d.

This is surely a distinct species, though the adult is much like several others. The vasiform orifice, etc., present some similarity to those of the larva of *A. decipiens* Maskell, but in other respects there is no resemblance between the species.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING ON MARCH 17, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Eleven members present.

Mr. Birnbaum read a paper on Phosphorescent Insects and Plants, illustrated by insects and figures. Discussion by Messrs. Dyar, Loos, Beutenmüller and Zabriskie. Mr. Beutenmüller exhibited some branches from the United States of Colombia with the borings of a large carpenter bee with live larva and imagos, the tunnels being about an inch in diameter.

MEETING OF APRIL 7, 1896.

Held at the American Museum of Natural History.

President Zabriskie in the chair. Eleven members present.

Dr. Love spoke on the larva of the Bot-fly.

Dr. Lagai exhibited some entomological preparations, preserved in formaline, which included some interesting life-histories of insects. After discussion the meeting adjourned.

MEETING OF APRIL 22, 1896.

An auction sale of insects was held for the benefit of the JOURNAL. The specimens for this purpose were donated by Mrs. Slosson, and Messrs. Palm, Bradford, Dyar, Ottolengui, Schaeffer, Münch, Loos and Joutel. Many of the species brought good prices; the total amount realized being $77.35. Dr. Ottolengui and Mr. Beutenmüller acted as auctioneers.

MEETING OF MAY 5, 1866.

Held at the American Museum of Natural History.

In the absence of the President, Mr. Beutenmüller was elected chairman *pro tem*. Nine members present.

Mr. Beutenmüller spoke of the 4th of July field meeting to be held at Hemlock Falls, N. J., to which the Society had been invited.

Dr. Love moved to appoint a committee of three, of which the chairman of this meeting shall be chairman. Accepted.

Mrs. Louise Moschell was proposed as an active member by Mr. L. H. Joutel.

Mr. Dyar exhibited examples of the Callemorphas of our fauna and showed some larva of *C. falvicosta* from Maryland.

Dr. Love gave a few notes on the field meeting, made by the Society to St. Mary's Lake.

Adjournment.

MEETING OF MAY 19, 1896.

Held at the American Museum of Natural History.

President Zarbriskie in the chair. Eleven members present.

Mr. Beutenmüller spoke on the advisibility of sending the JOURNAL to the different Entomological Societies with a view to exchange. After discussion Dr. Love moved that the publication committee be authorized to send out vols. 3 and 4 at its discretion, not to exceed 25 copies.

Mrs. Louise Moschell was elected an active member.

A vote of thanks was given to Mr. Miller, of No. 141 E. 40th St., for giving the use of his hall to the Society to hold the auction sale of insects.

Mr. H. Loos read an interesting paper on the stridulating and hearing organs of insects in which he gave the different ways of producing sound and explained the sound-producing organs of the different insects. Illustrated by plates, microscopical slides and insects.

Dr. Love exhibited an interesting series of slides illustrating the mechanism of the drum of the Cicada.

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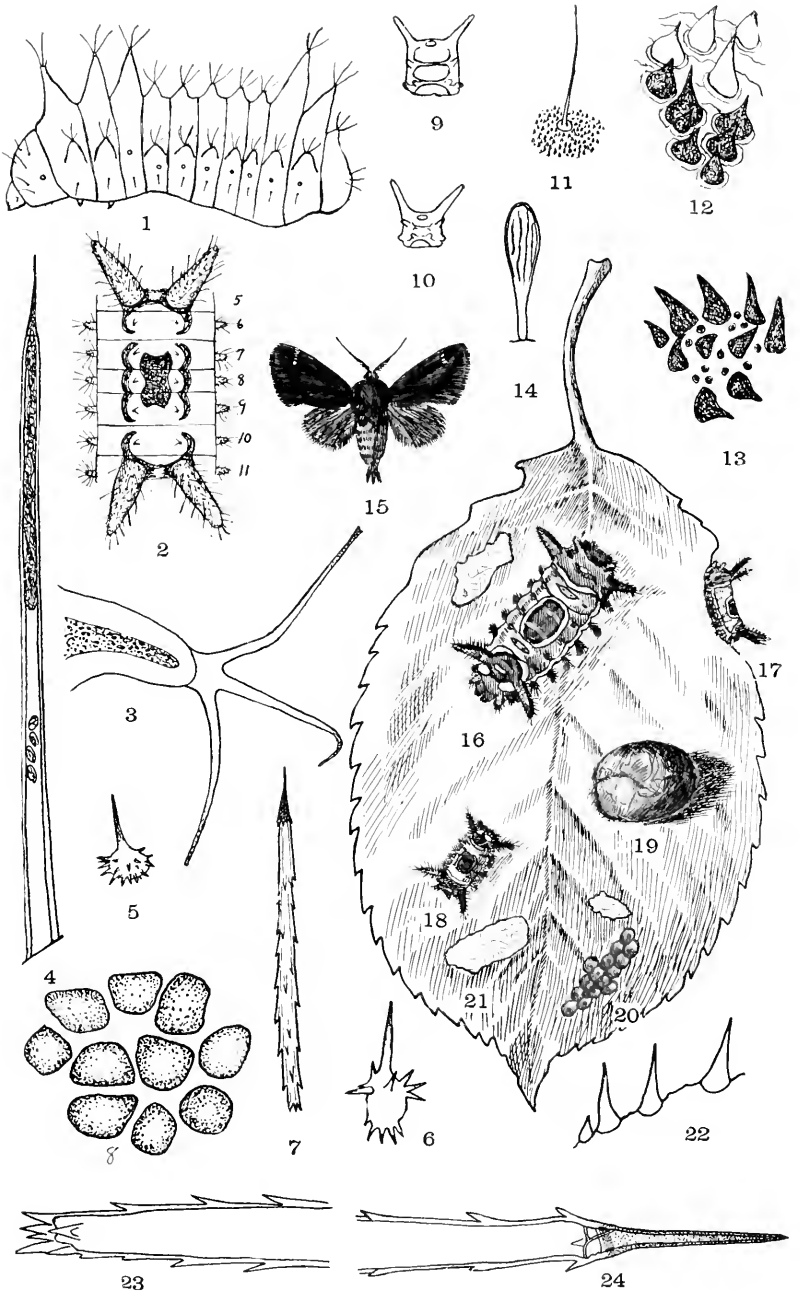
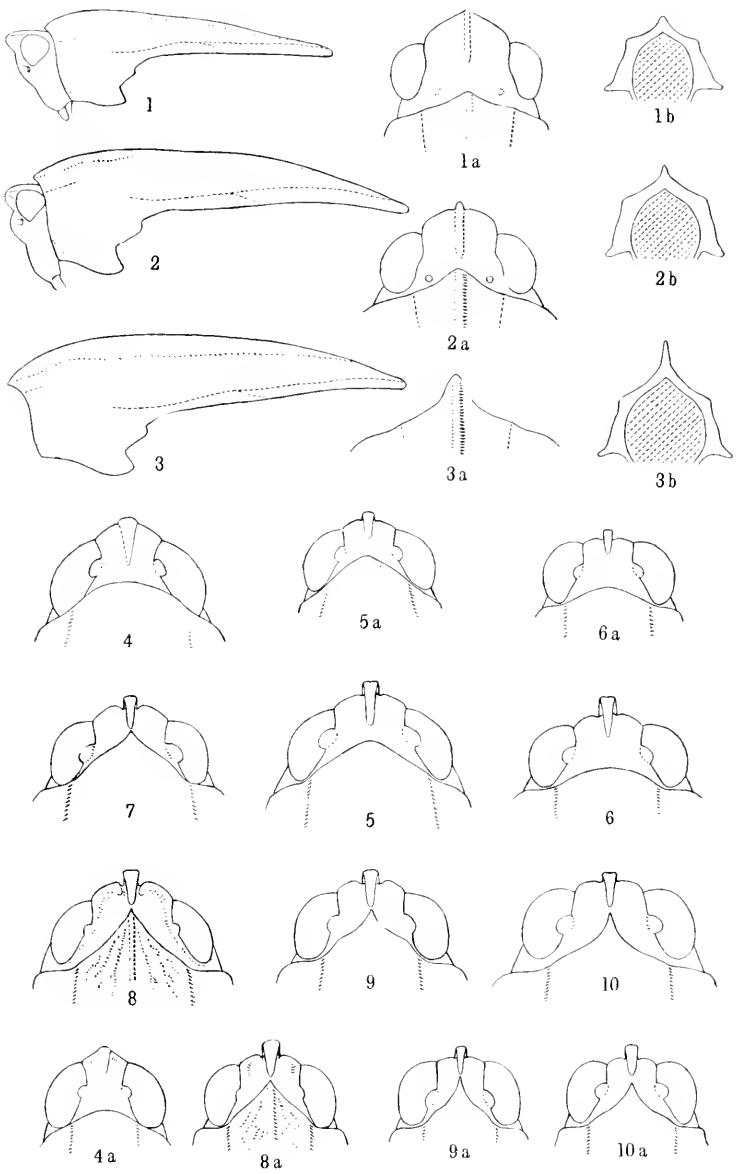
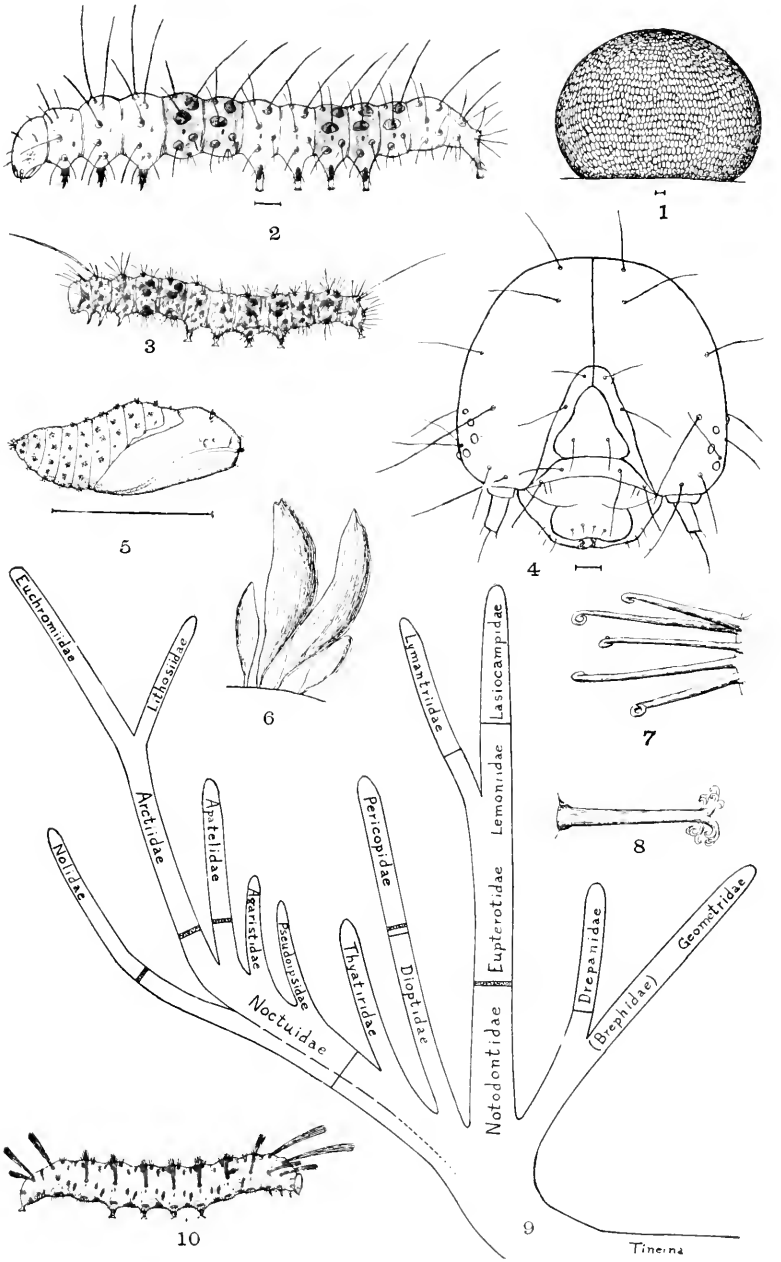


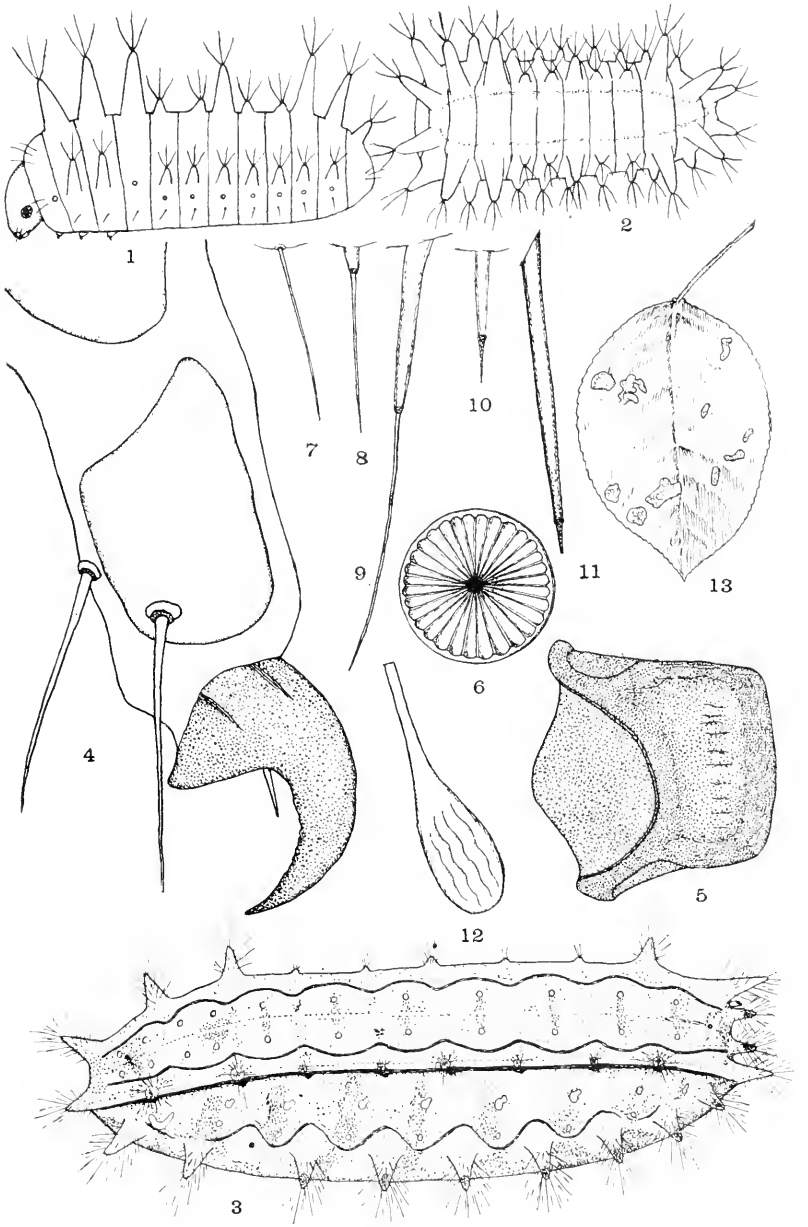
Life-History of Sibine stimulea.



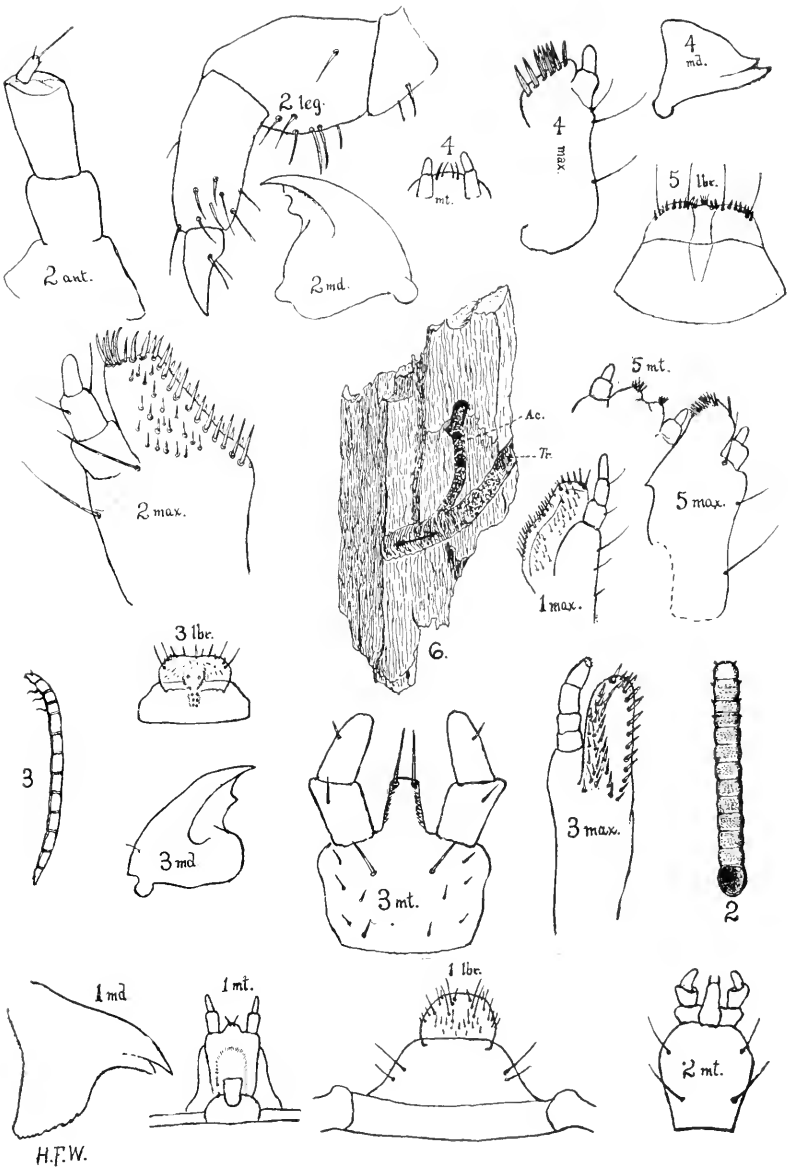
North American Tettiginæ.



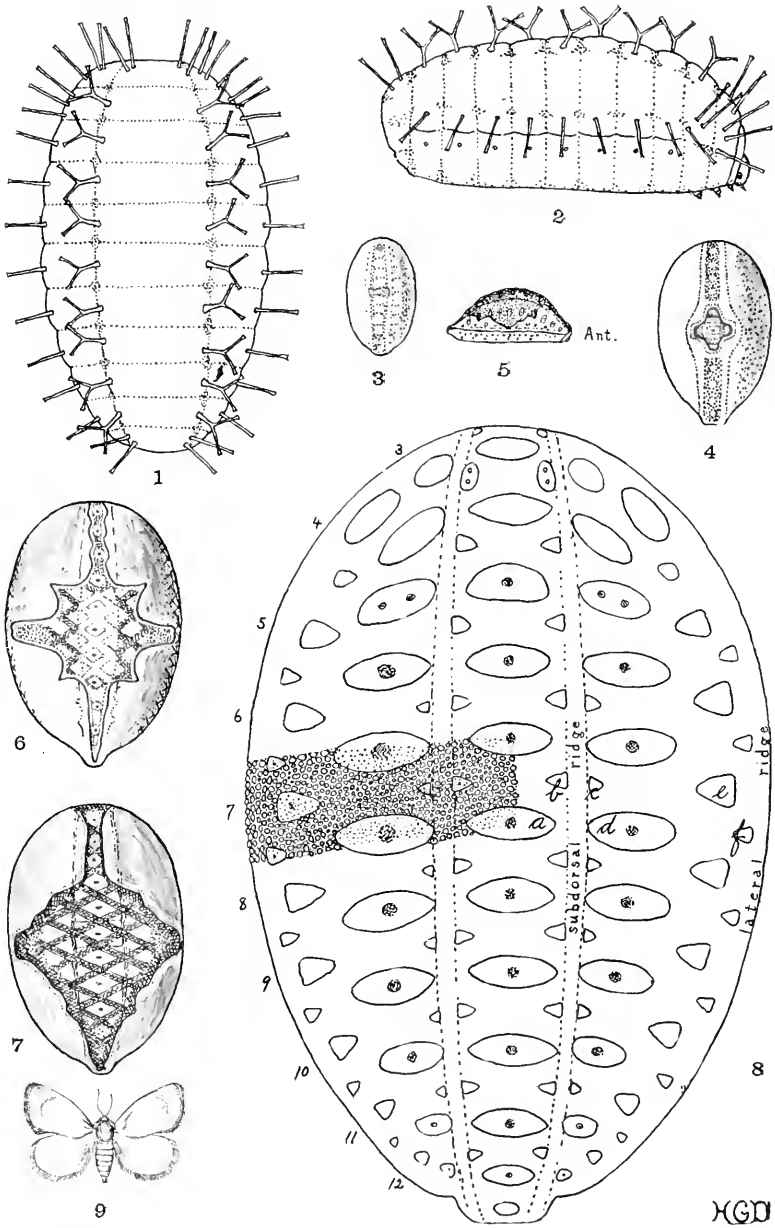
Larvæ of Composia fidelissima and Syntomeida epilais.



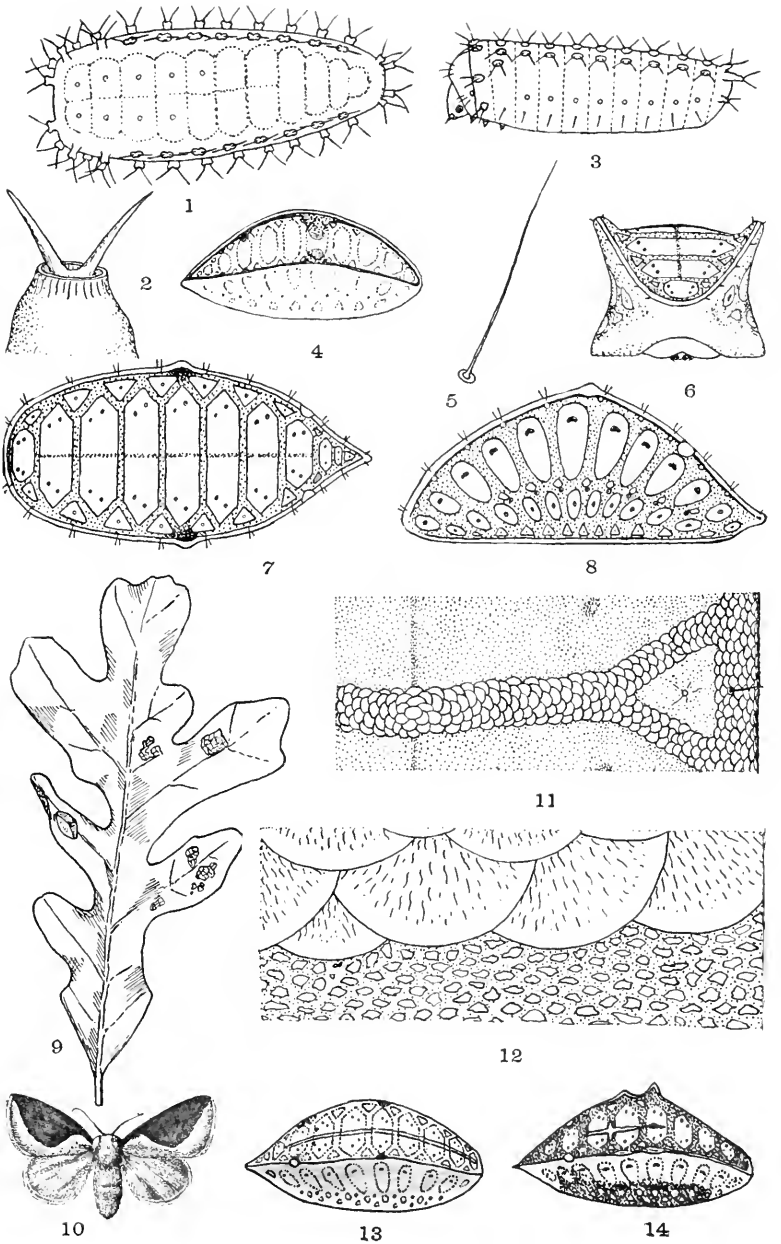
Life-History of Euclea delphinii.



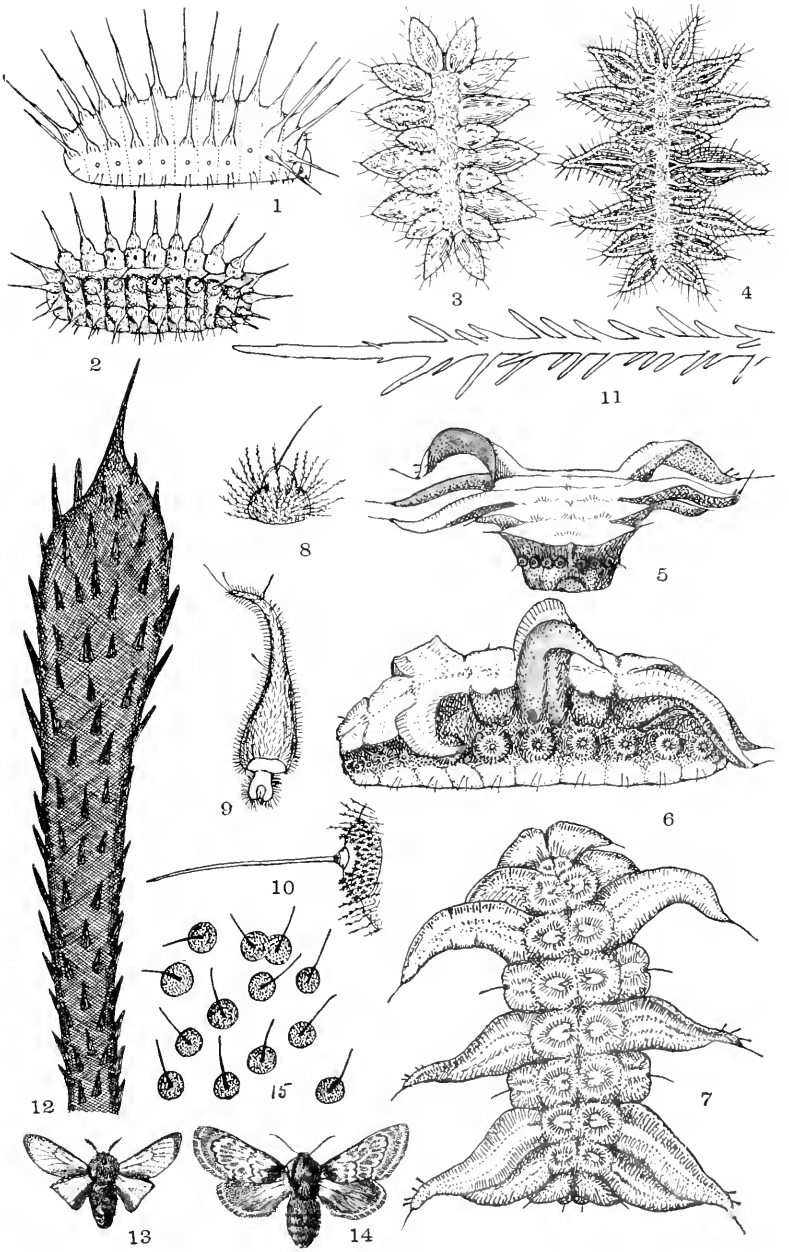
Coleopterous Larvæ.



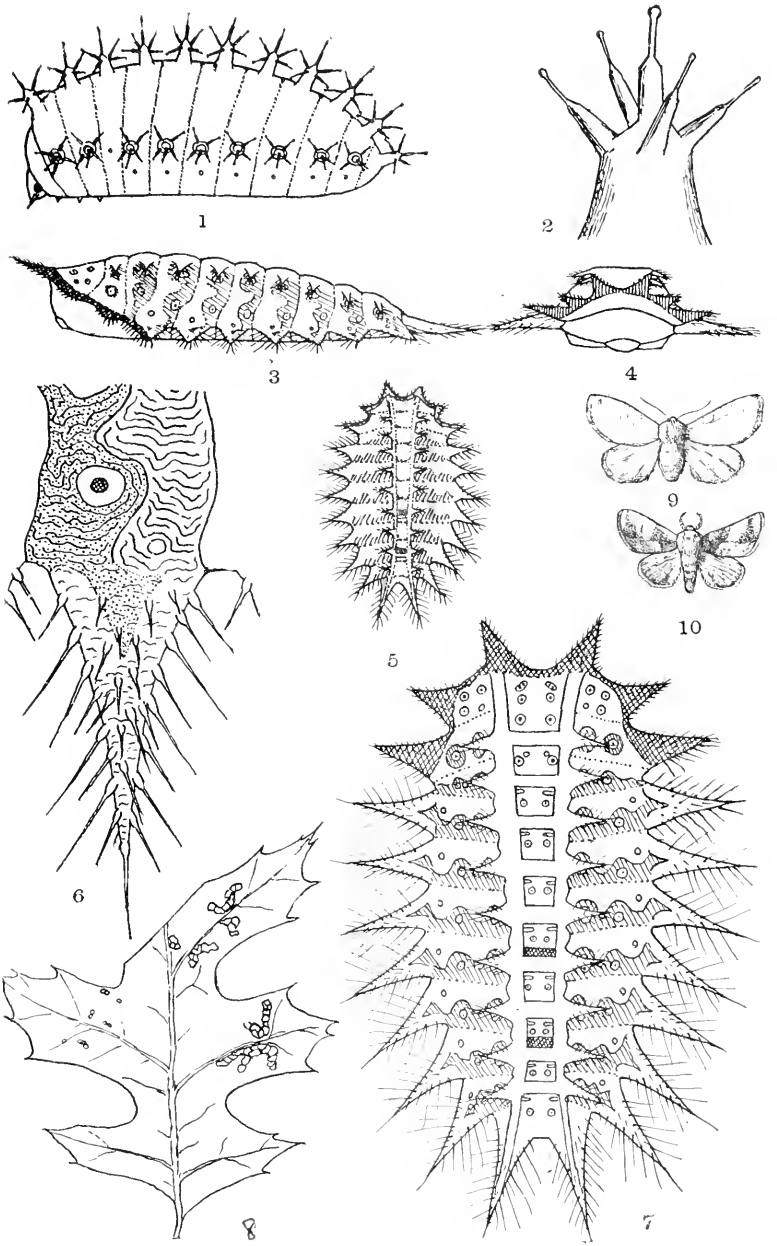
Life-History of Tortricidia pallida.



Life-History of Eulimacodes scapha.



Life-History of Phobetron pithecium.



Life-History of Sisyrosea textula.

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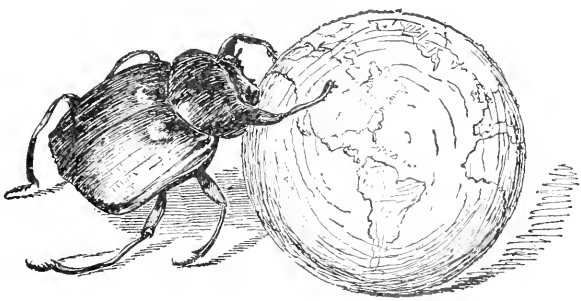

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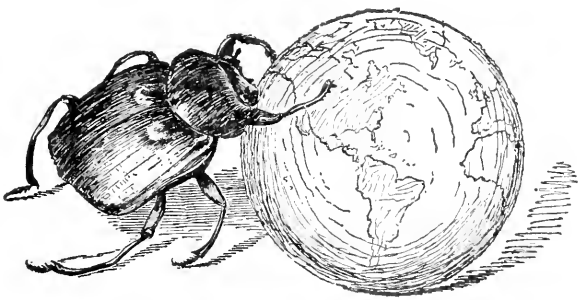

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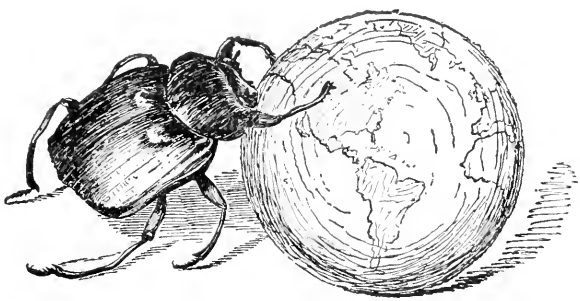

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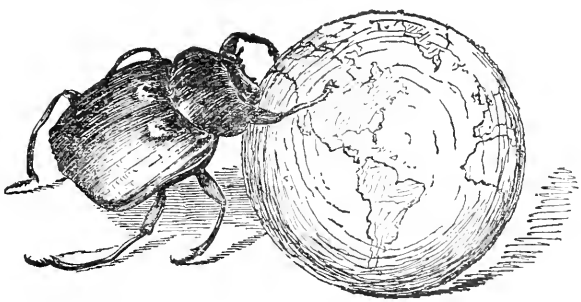

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All interested in Entomology are cordially invited to attend.

Annual dues for Active Members, $3.00.

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